

THE PRACTITIONER

Edited by

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Abbreviations: *abs* — Abstract; *NQ* — Note and Query; *RC* — Revision Corner

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THE PRACTITIONER

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EDITORIAL

New Year starts with prospects of an improvement in the paper supply. In the past seven years the publishers of *The Practitioner* have been hampered by an allotment inadequate to the needs of the journal, and the quality to that on which it was produced before the war. Although post-war economy is still essential, involving, among other things, the abandonment of plans for improving the typographical setting of the journal, it will be possible during the coming year to provide space for an increasing number of illustrations. Most of the additional paper supplies available will at first, however, be required to meet the pressing demand of new readers from all parts of the world.

In this, the first issue of 1947, we begin a series of articles on "Pain Problems". For the practitioner to-day, as for his predecessors, pain is an ever present problem. What is the cause of pain? What is its diagnostic significance? How can it be relieved? Such are the many questions that are constantly presented to the clinician. It is our task and which, in this series, *The Practitioner* hopes to be able to help him to answer. In the first article of the series, published in this issue, Professor Adrian discusses the general problem from the point of view of the physiologist, and he will be followed by Dr. Gordon Holmes, who will write on the general problem from the clinician's point of view. Subsequent articles in the series will deal with the problem as it affects the various systems of the body.

"Pain Corner", which appeared as a new feature a year ago, has been so popular that it will be continued in the coming year. A new feature in this issue is "The Practitioner: Fifty Years Ago". This consists of extracts from the issue of *The Practitioner* for January 1897. Forthcoming issues will contain excerpts from the corresponding issue of fifty years later. In thus providing a running commentary upon the state of medicine half a century ago it is hoped to present a feature which will be of interest to both old and new readers, as revealing something of the past of medicine and also of the rapid progress that has been made in all these sciences.

It has always been the aim of *The Practitioner* to provide a forum for the discussion of medical problems, and we hope that readers in all parts of the world will continue to turn to us in their difficulties, to help us by suggestions, and to contribute short articles of clinical interest.

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The history being finished, we slip a thermometer into the patient's mouth, take his pulse, noting its tension no less than its rate, and look carefully once more at the abdomen. We observe the respiratory movements of the abdominal wall—whether they are even, whether all segments take part in them. We watch for movements of the viscera; normal intestinal movements are visible when the peritoneum is covered by little except skin, as it is in wasted old women with divaricated recti or in patients with large ventral herniæ; but any peristalsis that can be seen through an undamaged abdominal wall is abnormal. We also note alterations in contour, the epigastric fullness of an acute dilatation of the stomach, the fullness in the right iliac fossa of a dilated cæcum, the left-sided fullness of a volvulus of the pelvic colon, the dome-shaped abdomen of small intestine obstruction, the square one of large intestine obstruction.

By *palpation* we learn of the movements and tenseness of the abdominal wall; of the size, shape and consistency of structures lying within the cavity, and of tenderness. The principle of palpation is the crescendo, to proceed from wide to localized examination, from superficial to deep, from painless to painful. First we examine with the flat of both hands, laying them on symmetrical parts of the abdomen, the epigastrium, the hypochondriac regions; the umbilicus, the flanks, the iliac fossæ, the hypogastrium. By this examination any hyperæsthesia or superficial tenderness, any gross alteration in outline or in the consistency of underlying structures (such as the rounded lump of a colon volvulus or the doughy mass of blood clot in the left flank when the spleen is ruptured), and the general distribution of guarding, resistance, or rigidity will be noted. We learn whether an area of rigidity is segmental, unilateral, or corresponds to some underlying organ or peritoneal compartment, and whether it varies from time to time as the patient's attention is led away. Comparison of the two flanks for muscular guarding is an important examination too often neglected; often increased tone can be detected here in the early stages of appendicitis, particularly if the appendix is para- or retro-cæcal, some hours before it is discernible over MacBurney's point.

After this surface survey we should palpate more deeply with one hand, going over the same areas in the same order, and using the second hand to thrust forward and support the posterior abdominal wall when the flanks and hypogastric regions are being examined. Finally, we press deeply with the index and middle fingers of the right hand to confirm facts already discovered and to probe doubtful areas more deeply. Large tumours and diffuse tenderness are found more easily with the hand; small lumps and localized tender areas with the fingers. By *rectal examination* we may discover lumps, and we shall certainly find tenderness over Douglas's pouch if the peritoneal cavity contains any pathological fluid, i.e., in the great majority of genuine abdominal emergencies.

Auscultation of the chest is important in any abdominal emergency. Auscultation of the abdomen tells us little, but that little is of crucial

DIAGNOSIS AND DECISION IN THE ACUTE ABDOMINAL EMERGENCIES

By SIR HENEAGE OGILVIE, K.B.E., D.M., M.Ch., F.R.C.S.

Surgeon, Guy's Hospital.

I. DIAGNOSIS

THE acute abdominal emergencies strike unheralded into the daily life of families that until then were healthy, secure and unfearing. We are summoned to the patient's bedside because something dreadful has suddenly happened; he cannot say what. Usually he complains of a sudden pain new in his experience. We must therefore begin by taking a history, or rather receiving a history, for we should allow the patient to tell his own story and should reserve questions for the end, to clear up doubtful points and to obtain information on related matters that have suggested themselves.

First, as we sit by the patient watching and listening, we soon form a shrewd idea, not merely of his trouble, but of the manner of man he is. We are able to assess his intelligence, his courage, his way of looking at life, and this homely bedside psychology gives us the key to much of what follows, enabling us to interpret his descriptions in terms of the average, to assess more accurately his reactions to later examinations, and sometimes indicating the kind of disease from which he may be suffering; for some acute emergencies, such as duodenal perforations, and some pseudo-emergencies, such as colon spasm, occur particularly in the obsessed and harassed.

Secondly, we shall soon reach that most valuable of all decisions, impossible to make with certainty at the first glance—how ill he is. We shall, as the minutes pass, inevitably note some of his reactions to pain, the writhing of colic, the restlessness and thirst of hæmorrhage, the stillness of peritonitis, the catch at the breath of a para-diaphragmatic lesion. We shall observe any increase in the respiratory rate, and whether the alæ nasi are called into play. As the narrative proceeds we uncover the abdomen and, as we listen, we watch its movements and see them unmodified by conscious control, which comes into play as soon as he stops talking about his trouble, and starts thinking about it.

Thirdly, as we listen, and without alarming him, we shall do well to lay our hands gently on the abdomen and move them about, not feeling for anything in particular, but letting them act as the tambours of an infinitely sensitive plethysmograph whose pen is recording on the tablets of our mind. We must know if this attack is an isolated one, or if it is merely the most severe of a series. In any abdominal emergency we need to know about vomiting, opening of the bowels or the passage of flatus, and about any abnormality in micturition or in the appearance of the urine. If the question of cancer arises, we must know about loss of weight, of strength, and of appetite.

Puzzling though these pseudo-abdominal emergencies can be when first seen, and considerations of space prevent my discussing them more fully here, doubt seldom remains after a complete examination. None of these conditions gives tenderness in the pouch of Douglas on rectal examination. None of them, except uræmia, abolishes the sounds of peristalsis.

The third question that must be answered as soon as possible is "does this case require operation or not?", and if the answer is in the affirmative, the subsidiary question arises, "should operation be performed now or as soon as the patient can stand it, or should it preferably be postponed to a later date?" To answer this question a diagnosis is desirable, but failing an exact diagnosis which may still elude us, it is nearly always possible to put the case with certainty into one of the three categories which between them include all abdominal emergencies—the infections, the colics, the hæmorrhages. In the more general sense it may be said that an infection has symptoms and physical signs; a colic has symptoms but at first no physical signs; a hæmorrhage has physical signs but no symptoms. In an equally general sense an infection needs operation but not immediately, except in the case of appendicitis and duodenal perforation; a colic needs operation immediately if it is due to intestinal obstruction, but otherwise only after due consideration and usually not in the present attack; a hæmorrhage needs operation at once.

II. DECISION

An abbreviated list of the common disasters which present themselves in the guise of acute abdominal emergencies serves to emphasize how many are the conditions which must be borne in mind, and how difficult may be the distinction between them.

<i>Stomach and duodenum</i>	Perforated ulcer Acute dilatation of the stomach Massive hæmorrhage from ulcer
<i>Small intestine</i>	Obstruction by bands Strangulation in hernial sac Infection, torsion, or obstruction associated with Meckel's diverticulum Perforation Regional ileitis
<i>Appendix</i>	Appendicitis
<i>Large intestine</i>	Obstruction due to carcinoma Obstruction due to volvulus Obstruction due to intussusception Perforation or acute abscess associated with diverticulitis
<i>Gall-bladder</i>	Gall-stone colic Acute cholecystitis
<i>Pancreas</i>	Acute pancreatitis
<i>Peritoneum</i>	Acute blood-borne peritonitis
<i>Urological emergencies</i>	Renal or ureteric colic Ruptured bladder
<i>Female pelvic organs</i>	Torsion of ovarian cyst Torsion of fibroid Acute salpingitis Ruptured ectopic gestation

importance. In an abdomen full of fluid the heart sounds are heard in all parts with startling clearness. Most significant are the sounds of intestinal movements; when normal, these are squeaks rather than gurgles, like the sound made by a wet finger rubbed over glass, and they vary in frequency from one to ten a minute, according to the stage of digestion. Silence lasting for more than two minutes is abnormal. We must be able to recognize two departures from normal: the noisy gurgling abdomen of an early intestinal obstruction and the sepulchral silence of peritonitis. Noise does not necessarily mean normality; but silence means danger, usually the need for laparotomy.

Percussion is the least useful method of abdominal examination, but it should not be omitted. By percussion we can outline a dilated stomach or a distended cæcum, and can detect free fluid or free air in the peritoneal cavity when they are present in gross quantities.

In many cases we shall be able, after marshalling our facts, to give the diagnosis, differential diagnosis, prognosis, and treatment, without hesitation; in some, particularly those seen in the earliest stages when diagnosis is difficult but decision is essential, we can do no more than place them in a rough category, but one that will enable us to answer the three questions that matter:—

Is this a genuine emergency, of possible serious consequences, or some temporary upset that will right itself?

If it is a genuine emergency, is it medical or surgical, that is, is it a case in which the question of early operation must be seriously considered?

If it is surgical, should operation be undertaken now, left to a more favourable time, or postponed indefinitely?

Having concluded that the patient is sufficiently ill to be admitted to hospital, we must decide as soon as possible whether he is suffering from a condition that will probably require an operation for its relief. The medical diseases which most frequently mimic surgical emergencies are the following:—

Medical condition
Coronary thrombosis

Basal pneumonia

Crises of tabes dorsalis

Spinal caries

Acute pyelitis
Uremia

Surgical emergency which it may simulate

Perforation of duodenal ulcer

Gall-stone colic

Acute cholecystitis

Acute pancreatitis

Appendicitis

Pneumococcal peritonitis

Acute cholecystitis

Perforation of duodenal ulcer

Gall-stone colic

Renal colic

Intestinal obstruction

Appendicitis

Intussusception

Intestinal obstruction

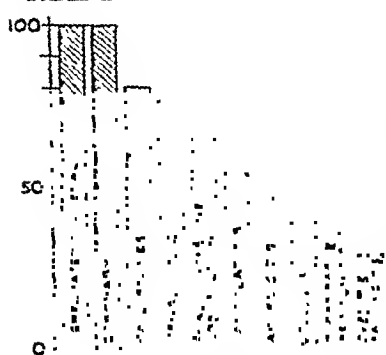
Pneumococcal peritonitis

Acute appendicitis

Large intestine obstruction

a pain includes, besides its severity, its quality, particularly whether it belongs to the splanchnic or the somatic systems of sensation.

TABLE B



Splanchnic pain arises in organs innervated by the sympathetic system, and is produced when their walls are stretched or their mesenteries are pulled open. Such pain is felt deeply and localized vaguely. It is unlike anything the patient has experienced before and is therefore described with difficulty, often in words and similes that call forth quaint imagery.

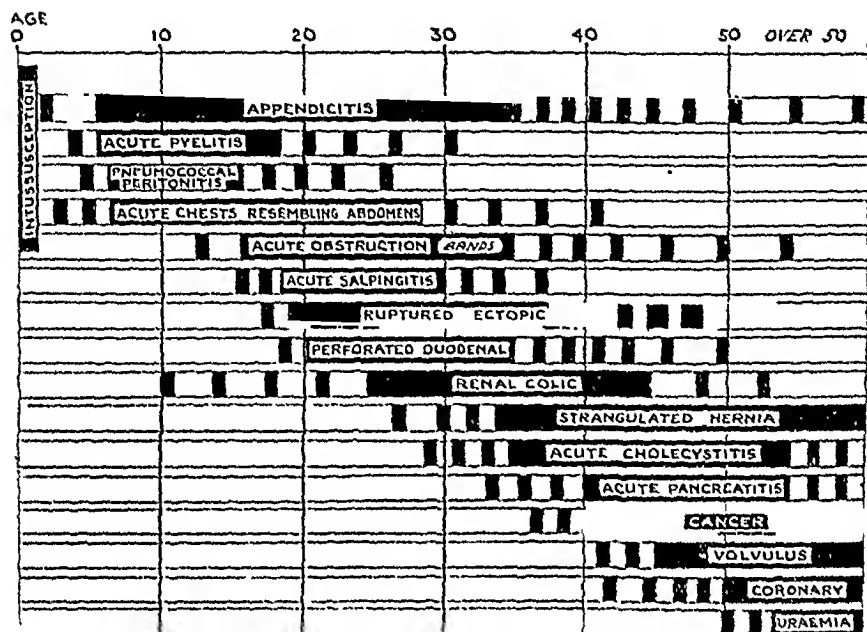
Somatic pain arises in structures supplied by the cerebrospinal sensory nerves which also supply the skin and muscles, that is, in the parietal peritoneum covering the anterior and posterior abdominal walls and lining the subdiaphragmatic space and the pelvis and extending some distance up the roots of the mesenteries. The pain is evoked by all stimuli that are painful when applied to the skin, by cutting, burning or strong chemicals, and even by lighter contacts which on the surface of the body would give a sensation of touch only, such as stroking with a gauze swab. Somatic pain is described in common terms, as burning, cutting, or pricking, and it is accurately localized.

The site of splanchnic pain is indefinite, and represents the embryonic rather than the actual position of the organ in which it arises; thus pain arising in structures derived from the foregut, the stomach, duodenum, liver, gall-bladder and pancreas, is felt in the epigastrium; pain arising in the midgut, that is from the duodeno-jejunal junction to the mid-transverse colon, is felt at or above the umbilicus, and pain arising in the hind-gut in the hypogastrium. The site of somatic pain is accurately localized to an area on the surface of the body supplied by the nerve the deep fibres of which are receiving the painful stimulus, and which generally overlies the site of disease, but in the case of the diaphragm is felt at its embryonic level, the area over the acromion supplied by the 4th and 5th cervical roots which also enter into the phrenic nerve. The site of abdominal pain, when splanchnic, indicates the organ involved or the embryonic group to which it belongs; when somatic, it indicates the anatomical location of the mischief, irrespective of the organ in which it arises.

Areas of reference, in the case of splanchnic pain, are not often of value. The area over which splanchnic pain is felt is in any case diffuse, being indicated by the palms of both hands, whereas somatic pain is pointed out with one finger; but splanchnic pain is seldom referred to distant areas: only in the case of gall-stone colic, in which pain may be felt between the scapulæ, and renal colic, in which it may be felt in the testicle, is referred splanchnic pain at all helpful. In the case of somatic pain, reference to a

When seeking a diagnosis in an abdominal emergency we should be guided to some extent by our knowledge of what is likely in a patient of that age,

TABLE A



sex, appearance and bodily habit. A chart showing the age incidence of the commoner surgical emergencies and the medical cases that imitate them is given in table A.

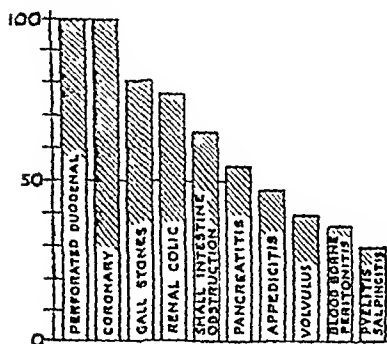
PAIN

When we have investigated a case in this category by all the means at our disposal, and have come to a final review, we will usually find that the chief item, in many cases the only significant item, in our dossier is pain. Usually the patient has come to us because of pain, and there is little except pain to help us decide what is the matter with him. There are nine aspects, at any rate, of pain that must be considered; its nature, its site, its areas of reference, its periodicity, its time relations, its mode of onset, its mode of departure, factors causing or aggravating it, and factors relieving it.

The nature of a pain will tell us much. Its severity is important. A pain that requires morphine is not appendicular, one that does not require it is not due to gall-stone colic. In assessing severity we must apply to the patient's estimate the personal corrective factor that we know to be right from previous experience of him, or that we have assigned to him from *ad hoc* assessment; in interpreting it we must apply a scale based on our experience—one that fits in with my own is given in table B. The nature of

a pain includes, besides its severity, its quality, particularly whether it belongs to the splanchnic or the somatic systems of sensation.

TABLE B



Splanchnic pain arises in organs innervated by the sympathetic system, and is produced when their walls are stretched or their mesenteries are pulled open. Such pain is felt deeply and localized vaguely. It is unlike anything the patient has experienced before and is therefore described with difficulty, often in words and similes that call forth quaint imagery.

Somatic pain arises in structures supplied by the cerebrospinal sensory nerves which also supply the skin and muscles, that is, in the parietal peritoneum covering the anterior and posterior abdominal walls and lining the subdiaphragmatic space and the pelvis and extending some distance up the roots of the mesenteries. The pain is evoked by all stimuli that are painful when applied to the skin, by cutting, burning or strong chemicals, and even by lighter contacts which on the surface of the body would give a sensation of touch only, such as stroking with a gauze swab. Somatic pain is described in common terms, as burning, cutting, or pricking, and it is accurately localized.

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skin area is the rule, and sometimes this area is also hyperæsthetic. The skin area indicates the site of the pathological lesion, or rather the site of the area of parietal peritoneum that is being hurt, which may be some distance away from it, as when a leaking duodenal ulcer gives pain in the right iliac fossa owing to the dribbling of duodenal contents down the right para-colic gutter.

By the *periodicity* of pain is meant its incidence over months or years. Very often the spacing of previous attacks will give the clue to the nature of the present one. Gall-stone attacks come as bolts from the blue, without reason, without warning, without regularity; they are over in a few days. Bouts of ulcer pain come slowly, last for weeks, and go slowly; they often have a preference for certain months. By the *time relations* of a pain we mean its behaviour during the twenty-four hours, particularly its association with meals, with other bodily functions, with lying down and getting up, with rest and movement.

The *mode of onset* and *mode of departure* tell us much. A colic usually starts with the gun, unheralded except in some cases by a short period of malaise; the pain tends to stop equally suddenly, only to start again, the intervals between bouts becoming progressively shorter. When a colic ceases, it stops as a pain, but often leaves some soreness, brought on by movement or pressure, lasting for a few hours. A perforation comes on with equal suddenness, but the pain has no intermissions and only subsides slowly as the peritoneum becomes used to the exudate. On the whole, the pain of an infection starts imperceptibly, takes some hours to reach its maximum intensity, where it remains steady, perhaps throbbing with the pulse, and if it subsides without operation, does so as slowly as it came.

The *factors causing or relieving* pain are usually mechanical—movement or pressure. Pain arising in any hollow organ is nearly always increased by its activity and relieved by its quiescence, because function is usually accompanied by movement of its walls and a rise of pressure in its lumen. A colic is little affected by anything, the patient usually saying that “nothing makes it better and nothing makes it worse”; pressure will sometimes give relief by counteracting from outside the internal pressure distending a hollow viscus, and that is why a man with an early intestinal obstruction tends to lie doubled up with his thighs pressed against his abdominal wall. The pain of an infection, which is due to the tension of engorged capillaries and œdema fluid in tissue planes, is aggravated by increase and decrease of pressure alike; pressure because it compresses the already tense tissues, negative pressure because it dilates the already dilated vessels still further. The pain of cholecystitis is often made worse by lying on the left side because in that position the liver tends to fall away from the diaphragm, producing a negative pressure around the inflamed gall-bladder, and increasing the pain in much the same way as sucking a hollow tooth causes it to ache. Pain arising in a deep-seated appendix may be brought more

easily into prominence by releasing suddenly a pressure gradually applied, than by direct pressure.

OTHER DIAGNOSTIC MEASURES

Accessory tests that are really worth the time they take after the patient is in hospital are not many. In a doubtful infection a leucocyte count should be done; in a doubtful hæmorrhage a hæmoglobin estimation. In a doubtful intestinal obstruction an enema must be administered, and if doubt remains after the first, a second and even a third should be given at intervals of an hour.

When intestinal obstruction is in question a straight X-ray should be taken of the abdomen. In a normal abdomen gas is seen in the large but not in the small intestine; when gas is demonstrated in the central square of the abdomen, intestinal obstruction is likely; when a single loop of intestine is seen outlined in gas it is highly probable, and when multiple gas-bubbles overlying fluid levels are seen, it is certain.

SURGICAL INTERVENTION

We have now made our diagnosis, or, if we have been unable to do so exactly, we have at any rate narrowed it down to one of the three groups—the infections, the colics, and the hæmorrhages. In each group, with the onset of the mischief, a natural mechanism comes into play to cure or relieve it. Often this mechanism is successful; often again it is the chief factor in success, surgery merely assisting or guiding it. Operation is therefore required only when the natural mechanism is likely to fail, or to achieve success at greater risk after more suffering, or leaving greater damage behind it than involved in operation.

The infections.—The peritoneum has developed the mechanisms of hyperæmia, exudation, and diapedesis of leucocytes to a high degree, and also has devices peculiar to itself.

The subperitoneal aerolar layer has an enormous reserve of blood vessels that dilate at the first call of danger; the surface cells are highly phagocytic and can detach themselves and wander off on independent commando work; the omentum has the same powers of reserve vascularity and specialized phagocytosis, and also the ability to reach any seat of trouble in the abdomen. When infection occurs in any part, the peritoneum, normally smooth and lubricated, becomes rough and adheres to neighbouring structures, lymph is poured out to make the barrier more secure, and intestinal movements are brought to a halt in the neighbourhood of the focus to assist in its isolation.

It is a rule of surgery and a dictate of common sense to respect a process so perfectly designed, and immediate operation is called for only when the danger of the infection overcoming the peritoneal defences is known from the experience of similar cases to be considerable, or when it is clear in a particular case that they are being overcome. If the defences can be trusted or are doing well, operation, even though it may be required to cure the condition that has given rise to the emergency, should be left to a quiet

interval when the patient is well and the local inflammatory process has subsided.

A *colic* is an indication that a hollow tube is trying forcibly to expel its contents, either because they are abnormal or because there is some obstruction to their passage. In gall-bladder or renal colic, especially the latter, the obstructing agent may be passed. In neither case is an emergency operation required, and a curative operation should be done later under planned conditions.

In *intestinal obstruction* there are special features that forbid delay. Obstruction is rarely due to foreign bodies in the lumen, nearly always to changes in the wall of the gut or to pressure from outside it. Such obstruction cannot be overcome by natural means nor will it relax even temporarily, when the muscular efforts of the bowel wall cease. The contents of the bowel are normally loaded with bacteria, and when they are dammed back above an obstruction they increase rapidly in amount and infectivity. The walls readily necrose with pressure or rupture if over-distended and, in giving way, flood the peritoneal cavity with toxic and infective material in amounts that are necessarily fatal. The treatment of intestinal obstruction is therefore always operative.

The natural mechanism for the *arrest of hæmorrhage* is closure of the hole in the vessel by blood clot which later becomes organized into fibrous tissue. Closure is aided by the low blood pressure which follows any severe hæmorrhage. In the abdomen, however, the pressure of surrounding parts which assists hæmostasis when a vessel is injured in one of the limbs is absent, and the knowledge of injury and the sight of blood, which warn the victim to keep still, are also lacking. The abdominal emergencies which present themselves as hæmorrhages are rupture of the spleen, rupture of an ectopic gestation, and bleeding from a posterior duodenal ulcer. In the first two, immediate operation is the rule; in the last it is the safest course, when expert surgery and abundant blood are available.

Finally, when all has been investigated, when all has been considered, doubt still sometimes remains. In such cases one course only is permissible; to act upon the most dangerous of the possible alternatives and to operate. Man diagnoses but God discloses, and it is infinitely better that an unnecessary operation should disclose a mistake made in all good faith than that an unnecessary post mortem should disclose a condition that operation might have cured.

CONCLUSION

The acute abdominal emergencies are the touchstones by which our worth as doctors is judged. When we meet them we must be prepared to sacrifice our labour, even our reputations; but we should remember that the one sacrifice for which there is no atonement is the sacrifice of time. It is better to be certain than to be right. Mistakes are nothing to be ashamed of if they are not due to laziness, to carelessness, or to the fear of making them.

ACUTE CHOLECYSTITIS

By SIR JAMES WALTON, K.C.V.O., M.S., F.R.C.S.

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Of all subjects in surgery, cholecystitis is one of the most fascinating, for there is hardly an aspect of its pathogenesis that has not led to acute controversy. The arguments on the pathological aspects are too lengthy to enter into here and are mainly of academic interest. I have discussed them fully elsewhere (Walton, 1945).

To-day acute cholecystitis is rarely seen unless gall-stones are present, but in the early days of this century, when typhoid fever was rife, it was relatively common as a primary condition, and it may rarely occur to-day in association with other acute infections. There is, however, a clear distinction, both pathologically and clinically, between those cases with an obstruction due to a stone in Hartmann's pouch or the cystic duct and those without such obstruction.

PATHOLOGY

With obstruction.—When a stone has become impacted in the cystic duct or, more commonly, in Hartmann's pouch, the gall-bladder will become distended although no bile can enter. With a low-grade infection the fluid will be clear or turbid mucus and the distention will be considerable. Such a condition may persist for weeks or months and a large tumour may form with but little evidence of infection. In such cases the stone or stones will become coated with a layer of pure cholesterol secreted from the inflamed gall-bladder wall.

If the infection be more acute the gall-bladder will be less distended, the contents may still contain bile as well as pus and blood, and the stones will still show the presence of pigment. The mucosa will be reddened, injected and perhaps ulcerated, the wall will be thickened and œdematous so that it is opaque, and the peritoneal coat will be injected. If left, the inflammatory changes will spread to surrounding tissues, such as the liver, omentum, stomach, duodenum or colon, which become adherent, so that if perforation occurs either a local abscess is formed or a fistula communicating with the gastro-intestinal tract. In the fulminating infections the stone in Hartmann's pouch being gripped by the gall-bladder may cause pressure necrosis of the mucosa with ulceration and a spreading cellulitis or phlegmon of the gall-bladder wall. This may progress to perforation at the site or, by obstructing the vessels, lead to gangrene and perforation of the fundus. In such acute conditions the contents of the distended bladder will be foul and grumous.

Without obstruction.—This is the type of lesion which may occur when no stones are present. It is then sometimes mild and transient and may be the first episode in a patient who later develops typical symptoms of gall-

stones. Occasionally it may also be fulminating. Much more commonly is it seen to-day in a patient who already has stones and may have had a long or short clinical history suggestive of such.

The main difference from the first group is the absence of dilatation of the gall-bladder, which may be relatively small. Here also, every degree of inflammation may be seen from an acute infection with blood, pus and altered bile in the cavity, ulceration and necrosis of the mucosa and gangrene of the bladder wall, to milder cases with turbid bile or some muco-pus around the stones, redness and injection of the mucosa, and œdema and injection of the wall. Here also, the surrounding omentum or viscera soon become adherent. Since the bile has been able to enter freely the stones will show visible pigment and will not be covered with cholesterol.

In either group, inflammation may spread to the gastro-hepatic omentum and cause a transient jaundice. More rarely this may be due to the simultaneous impaction of a stone in the common duct or to an acute associated pancreatitis.

The above conditions are factual and are illustrated in all good pathological museums, and are of course well displayed in the rapidly growing and rejuvenated museum of the Royal College of Surgeons. An appreciation of their nature is the key to an understanding of the clinical symptoms and of the treatment to be adopted.

SYMPTOMATOLOGY

The extreme variation in the pathological changes makes it evident that every degree of acute cholecystitis may be seen, from an early gangrene or perforation giving a typical picture of acute diffuse peritonitis, to one in which the symptoms are quite localized and of so mild a degree that they more aptly merit the term subacute.

Too much stress has been laid upon the fact that gall-stones most frequently occur in stout middle-aged women, 80 per cent. of whom are married and have children, for the disease is not infrequent in males and even in young adults, and in the experience of Robertson (1945) over 50 per cent. of 1,032 patients were under the average weight. That some 80 per cent. are married and have had children is true of all women between the ages of forty and sixty, whether they have gall-stones or not.

Obstructed cystic duct.—When the opening of the cystic duct is obstructed the onset will be with an attack of colic which may arise with startling suddenness, like the stab of a knife, or may begin as an attack of epigastric pain described as dyspepsia, which rapidly increases in severity until the patient is doubled up, sweats, vomits and is unable to keep still. If the attack has not been observed the severity of the pain may be best elicited by asking her if it were severe enough to make her lie down. If colic the answer will always be that the pain was so severe that she could not lie down. As the pain increases in severity it will radiate to the back and right shoulder. Generally there will have been previous attacks of colic so that

the patient may be quite conversant with their nature, but on this occasion the colic will not cease with startling suddenness as the stone slips back, or more slowly under the influence of an opiate, but will persist although altering in character. The pain will become constant and severe but not griping. At first it will be diffused over the whole abdomen although perhaps more evident on the right side; later it may become limited to the right upper abdomen. The temperature will be raised to 100 to 102° F. (37.8° to 38.9° C.), the pulse increased, and vomiting will be frequent. If seen at this stage the abdomen will show limitation of respiratory movements with some rigidity, most marked on the right side and in the upper quadrant. Hyperæsthesia may be present in the 8th to 12th right dorsal zone and deep tenderness will be diffuse but more evident in the right hypochondrium.

At this period a diagnosis may be difficult from acute appendicitis starting with appendicular colic or from acute pancreatitis. The past history, the distribution of the colicky pain, the more evident tenderness and rigidity in the right upper quadrant and the area of hyperæsthesia will be the important diagnostic points.

Intestinal or renal colic will not as a rule be associated with pyrexia; renal or intestinal symptoms are usually present and there is no abdominal rigidity. A gastric or duodenal perforation will usually show a past history of peptic ulceration, and the presence of board-like rigidity over the whole abdomen should settle the diagnosis.

Should a perforation occur or a diffuse peritonitis arise without perforation the symptoms will at first be those of peritoneal irritation, with a lowered temperature, a pulse at first slow and then rising, loss of all respiratory movement of the abdominal wall and a diffuse board-like rigidity. It will be easy to diagnose a perforation without wasting valuable time on an X-ray examination or a white cell count, but it may be impossible to say if the perforation be of the gall-bladder, the stomach or the appendix; but since each necessitates immediate operation its exact site is of less importance. Later, the symptoms, owing to paralysis of the gut wall, become those of acute intestinal obstruction with distention, absence of rigidity, complete constipation, frequent and foul vomiting and all the signs of dehydration.

More frequently the condition tends to become localized; the pain, the tenderness and the rigidity become limited to the right hypochondrium. Later, the rigidity passes and a pear-shaped tumour due to the distended gall-bladder becomes evident. This can be felt emerging from under the ribs, moves on respiration and is the only prominence on the edge of the liver, which is usually slightly enlarged and palpable. Its projection well beyond the edge of the liver makes it evident that it is not a liver abscess. It does not pass into the loin but is close under the abdominal wall and the colon cannot be felt in front of it, so that it can be distinguished from a renal tumour. The presence of fever, early history of the attack and absence

of intestinal symptoms should eliminate the possibility of a colonic tumour.

The acute changes may continue to abate, the swinging temperature and the tenderness slowly disappear, and the condition pass on to that of a painless mucocele which is, however, liable to acute relapses. At the onset of an attack, however, it is impossible to determine how the lesion will progress. Gangrene and perforation may rapidly occur, but even when the changes appear to be localizing a later perforation may take place, and it is for this reason that every case must be regarded as an acute emergency.

Unobstructed cystic duct.—When there is no obstruction of the opening, the onset of the attack will differ in that colic will be absent. The pain will arise gradually in the epigastrium and will at first be regarded as acute dyspepsia. It will slowly and steadily increase and with the onset of pyrexia the patient will feel ill. As the pain increases it becomes diffuse, and the physical signs, as in the last group, will be manifest, but the differential diagnosis from some other intra-abdominal inflammatory lesion, or even from an early pneumonia, will be more difficult in the absence of the attack of colic. With pneumonia definite physical signs should become evident at the right base within twenty-four hours, and even in the early stages the respiratory rate should show an unusual increase. The more evident localization of the physical signs to the right hypochondrium and the absence of cyanosis should distinguish it from acute pancreatitis, but long-continued flatulent dyspepsia and even colic and jaundice may have been present in both conditions, even if they are not associated. The area of hyperæsthesia, if present, will help to give an accurate diagnosis and to distinguish the attack from acute appendicitis. In the latter case the deep tenderness and the rigidity will be lower down unless the appendix is in a high retro-cæcal area, when a distinction may be very difficult.

As in the cases with obstruction the condition may progress to gangrene, to perforation, to abscess formation or may abate and become localized, but, as in that type, there is no means of determining which event will occur.

TREATMENT

It is on the question of the treatment of acute cholecystitis that the greatest controversy exists. The surgical literature of the last ten to fifteen years abounds with statistical essays attempting to prove that the best results are obtained by early or late operation, as the case may be, but personal discussion with many of the leaders of either school of thought has led me to believe that their views are not so divergent as their writings might infer. Although there are some who defer operation for three to four weeks in the belief that the acute condition will abate, the majority when asked how long they would postpone operation state "until the acute collapse and infection have been controlled and the patient has been adequately prepared". They generally add that there may be some contraindication to waiting which cannot be ignored. On the other hand those who believe in early, or as it is often called immediate, operation when asked how soon they would operate state "as soon as the patient has been adequately

prepared". It is evident that there is only a slight difference between two such statements. A wide experience of the pathological changes, a clear understanding that it is impossible to foretell how these changes may progress, and an appreciation of the fact that the longer the condition is left the more dense the adhesions and the more difficult the operation, make me a firm supporter of the latter view.

There can be no question that every case of acute cholecystitis must be regarded as an acute emergency and must be so placed, either in a nursing home or hospital, that an operation can be undertaken at the most appropriate time and suitable preparation for that operation can be immediately instituted. With this view I believe all surgeons will agree.

The preparation will of course consist in keeping the patient absolutely at rest in bed on a light diet from which it is customary to exclude fats and eggs, as they cause the gall-bladder to contract. Fluid with glucose will be given in fair quantities either by mouth or as rectal drip infusions. The hæmoglobin level must always be estimated and if low a blood transfusion given. If jaundice is present vitamin K may be administered. If the symptoms are not very acute the patient may be so prepared for a period not exceeding one to three days, sleep being aided by a sedative and the bowels opened by enemas. In the absence of any knowledge of a causal bacterial agent the use of the sulphonamides or of penicillin is at this stage entirely problematic.

If on admission, or during preparation, the symptoms are acute and suggest a perforation or gangrene, or if the general condition is deteriorating, an immediate operation should be performed, shock in this case being best controlled by an injection of morphine aided, if necessary, by intravenous transfusions of saline or plasma.

Into the technical details of the operation I do not propose to enter. It is sufficient to say that there is no operation in surgery which is more dependent for its results upon technical skill and that the most disastrous results may follow injury of the common bile duct or hepatic artery. Such injuries are only too common, but they should never occur if the surgeon is conversant with the anatomical relations and divides nothing until he is absolutely certain of its nature.

Generally speaking, no operation for gall-stones or cholecystitis can be considered complete unless the gall-bladder has been removed, the common duct explored, and the ampulla dilated, but with patients who are often so seriously ill it is the first duty of the surgeon to save life and not to attempt more than they can stand, even if by holding his hand there is a risk that further trouble may arise in the future. In the words of the late F. G. Jeans: "A living problem is better than a dead certainty". It thus happens that whereas in the early years of this century the routine operation was cholecystostomy, cholecystectomy being reserved for those cases in which the gall bladder was gangrenous or widely and acutely diseased, to-day the reverse is true. Cholecystectomy is the operation of choice, cholecystostomy

being performed only when the patient is so seriously ill that removal of the gall-bladder might gravely endanger life. In such cases drainage of the viscus with removal of the stones and the relief of tension may carry the patient safely over a great danger. It is true that in such a diseased gall-bladder future trouble is almost certain to arise from a recurrence of the inflammation or re-formation of the stones, but the cholecystectomy may be performed at a later and safer period.

It is true also that the presence of a stone in the common duct or of cholangitis may be a grave complication which necessitates the exploration and possibly the drainage, of the duct, and that such complications may be present in the absence of jaundice. That this is so is evidenced by the fact that on many occasions it has been necessary to operate on a patient for a stone in the common duct after a previous operation at which the surgeon removed the gall-bladder but did not explore the duct. Nevertheless, this exploration does increase the risk, especially in a short patient with a stout abdomen. If therefore there has been no jaundice, the cystic and common ducts are not dilated and no stone can be palpated from without, it is justifiable and indeed correct to leave the duct unexplored and to take the lesser risk that a stone in the common duct has been overlooked and later may necessitate another operation.

If cholecystectomy has been decided upon no structure must be divided until all three ducts and the cystic artery have been clearly exposed, when the cystic duct is divided and the artery ligatured and divided. This is the first lesson to be learnt in gall-bladder surgery, for it is only by its meticulous performance that irreparable damage can be avoided. If the common duct has to be explored this should be carried out through the divided and slit-up cystic duct. There is nothing to be gained by ligaturing the cystic duct and then making a second opening into the common duct. The second essential lesson is that after every cholecystectomy a tube should be inserted down to the sutured cystic duct. Even after the most careful suture or ligature of the stump of the duct, bile may escape, and it is now universally recognized that small accessory ducts may pass from the liver bed directly into the gall-bladder. No surgeon who has performed these operations on many occasions can have failed frequently to have seen such ducts. In cases of acute cholecystitis the infection is an added reason for drainage.

Even with these precautions an operation for acute cholecystitis is one of considerable magnitude in a patient who is often of poor physique and is exhausted and shocked by the severity of her symptoms and the acuteness of the infection. It is my firm belief that only by operation performed as soon as adequate resuscitation has been carried out can these risks be minimized and future dangers prevented.

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ACUTE PANCREATITIS

By JOHN MORLEY, CH.M., F.R.C.S.

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ACUTE pancreatitis is a somewhat uncommon abdominal emergency. It is important out of proportion to its frequency because it enters into the differential diagnosis of most upper abdominal catastrophies, and because of its high mortality.

CLASSIFICATION

The disease occurs in all grades of severity, from the most fulminating acute hæmorrhagic pancreatitis, or, as it is sometimes called, acute pancreatic necrosis, to a mild focal or general inflammation that is capable of almost complete resolution. Some authorities have classified the condition into (1) acute hæmorrhagic (or necrotic) pancreatitis, and (2) acute œdematous (or interstitial) pancreatitis, in the belief that there is a fundamental difference between the pathological processes involved in the two groups. In my view there is no real justification for this distinction, although there is a rare form of acute pancreatitis, due to mumps, which is undoubtedly in a class by itself.

PATHOLOGY: PREDISPOSING CAUSES

Acute pancreatitis is a disease of fairly late middle age, and is somewhat more common in men than in women. The patient is usually rather obese and may have suffered from hypertension. By far the most important predisposing factor is the presence of gall-stones. In most collected series of cases 60 per cent. or more of the patients are found to be suffering from gall-stones. In the classical case described by Opie in 1901, a small stone was found impacted in the ampulla of Vater at its entrance into the duodenum, and this appeared to have caused a reflux of bile into the pancreatic duct, thus activating the trypsinogen of the pancreatic juice and allowing autodigestion of the gland. Opie followed up this observation by injecting bile into the main pancreatic duct in dogs and produced acute hæmorrhagic pancreatitis. His experimental work was regarded at the time as affording strong confirmation of the theory of a common channel with a backward flow of bile into the pancreatic duct. Unfortunately for this view it has since been proved that impaction of a gall-stone in Vater's ampulla in cases of acute pancreatitis is a rare event. Schmieden and Sebening (1927) found that in a collected series of 1,278 cases a stone was impacted in this position in only 4.5 per cent. although 69.8 per cent. of the patients had gall-stones. There is a further difficulty in that, according to

the anatomical researches of Mann and Giordano (1923), in only 3.5 per cent. of individuals is the structure of the ampulla such that a stone impacted there could throw the bile and pancreatic ducts into direct communication. Nevertheless, this theory of a common channel has made a strong appeal to many investigators, and Archibald and Brow (1919) suggested that it might be brought about by a spasm of the sphincter of Oddi which surrounds the opening of the ampulla into the duodenum. Apart from these anatomical considerations there is some evidence that infected bile is a much more potent activator of trypsinogen than sterile bile, and there is no doubt that in most cases of gall-stones some bacterial infection of the biliary system is present. Many workers have tried injecting various fluids, both sterile and infected, into the pancreatic ducts of animals, and the results suggest that almost any fluid injected in this way will produce acute pancreatitis, provided it is injected in sufficient bulk and with sufficient force. The truth may well be that if normal pancreatic juice is forced through the ducts or alveoli into the tissue spaces of the pancreas it becomes activated, and tryptic digestion of the gland results.

How to account for the 30 or 40 per cent. of cases in which gall-stones are not found is a still more difficult problem. Rich and Duff (1936), in an histological investigation of acute pancreatitis, described a peculiar hyaline degeneration of the walls of the pancreatic arteries and veins in this disease. They regard it as the essential predisposing cause of the hæmorrhage into the gland and consider that it is due to escape of trypsin into the tissues. They also found in over 50 per cent. of cases evidence of obstruction to the pancreatic ducts by a hyperplastic metaplasia of the duct epithelium. In other cases they found ducts blocked by inspissated secretion. They suggest that these causes of obstruction may account for the cases of acute pancreatitis which occur in the absence of either gall-stones or bacterial infection.

CLINICAL PICTURE

It is only in severe fulminating hæmorrhagic pancreatitis that the clinical appearance of the patient enables a confident diagnosis to be made. The onset of the disease is sudden, although the pain does not develop with quite the dramatic suddenness of that due to a perforated peptic ulcer. The patient, who is commonly a stout plethoric individual, is stricken with a most severe pain in the epigastrium radiating through to the back. The fierce intensity of the pain is such that it is resistant to a full dose of morphine. Cases do occur in which the patient dies from shock or collapse within an hour or two of the onset. The pain is associated with marked tenderness but no great rigidity in the upper abdomen. Distension of the transverse colon and jejunum sets in very early in the attack and is often pronounced. The most characteristic signs of the disease, however, are due to a profound and rapid circulatory depression. The pulse is rapid and

feeble from the first, in strong contrast to the pulse of perforated ulcer, which in the early hours is slow and full. The temperature is often sub-normal and the respirations shallow and rather rapid. As a result of the circulatory collapse the patient becomes distinctly cyanotic in the lips and the tips of the ears. The cyanosis constitutes the most characteristic sign of the disease. Halsted pointed out that in some cases this cyanosis extends to the abdominal wall, so that on removing the palpating hand the white imprint of the fingers on the skin can be seen for a few moments. Vomiting in some degree is nearly always present and may be both urgent and prolonged.

In severe cases fortunate enough to survive, a sign described by Grey Turner (1920) may be detected several days from the onset. It consists of a slight bluish discoloration in both flanks and in the umbilical region, and is due to pigment from the extravasated blood tracking along the retro-peritoneal tissues and the falciform ligament. Although not a common sign, it affords convincing proof of the diagnosis.

It is only in the more severe forms of hæmorrhagic pancreatitis that the complete picture is seen, with the characteristic cyanosis, and in these cases the diagnosis is not difficult provided that the possibility of this disease is kept in mind. More commonly, however, milder cases are seen in which the disease gives rise to diffuse swelling of the pancreas with necrosis but no severe hæmorrhage, or to a hæmorrhagic infiltration limited to one portion only of the gland, and more usually to the head. It is these milder cases, lacking the circulatory collapse and the cyanosis of the severe form, which make the diagnosis of the disease so difficult. They often undergo spontaneous resolution and are prone to recur at intervals of a few months.

LABORATORY AIDS TO DIAGNOSIS

The time-honoured Læwi test of the textbooks, in which a drop of 1 in 1000 adrenaline instilled into the conjunctival sac produces dilatation of the pupil, is quite unreliable. It is often negative in genuine acute pancreatitis and may be positive in other conditions. The most reliable laboratory test is the *estimation of the amylase* in the urine or the blood. Some authorities prefer the blood amylase, but the urinary amylase is technically easier to estimate. The amylase in both the serum and the urine is raised very decidedly on the first day of the attack. The serum amylase returns to normal within two or three days, often before the clinical symptoms have subsided. The urine amylase remains elevated some twenty-four hours longer than the serum amylase (Cole, 1938). In the most fulminating cases the test may be negative because the destruction of the pancreas is so complete that no enzyme can be produced. Slight glycosuria may occur in acute pancreatitis but is transient and inconstant: the same applies to an increase in the blood sugar.

RADIOLOGICAL DIAGNOSIS

Although most patients with acute pancreatitis are too ill to be subjected to X-ray examination, there is some evidence that it may be of value in the less severe cases. Three positive signs have been found:—(1) A tender swelling of the pancreas on palpation under the fluoroscopic screen. (2) Raising of the greater curvature of the stomach and separation of it from the transverse colon, with enlargement of the duodenal loop due to the swollen pancreas. (3) Localized ileus and gas distension in the transverse colon and upper jejunum (Methany, Roberts and Stranahan, 1944).

DIFFERENTIAL DIAGNOSIS

It has already been explained that the combination of an agonizing upper abdominal pain, a rapidly failing pulse and cyanosis makes the recognition of a fulminating case of acute pancreatitis an easy matter for a surgeon who bears the possibility of this disease in mind. In the less severe cases, however, in which the pain, although intense, is not associated with cyanosis or tachycardia, the diagnosis is far from easy. The condition may be taken for acute obstructive cholecystitis, perforation of a peptic ulcer, high intestinal obstruction, or even for coronary thrombosis.

Acute obstructive cholecystitis is closely simulated when acute pancreatitis is limited to the head of the gland. In obstructive cholecystitis, however, the temperature rises early in the attack, and tenderness and rigidity are more pronounced than in pancreatitis, and they spread down the abdominal wall as the inflamed gall-bladder becomes more distended. The diastatic index will not be raised in obstructive cholecystitis.

Perforated peptic ulcer is usually preceded by periods of epigastric pain occurring some two hours after food, and relieved by food or alkali. There is more extreme tenderness and rigidity than in acute pancreatitis, and the pain starts with a dramatic suddenness, so that the patient can time the moment of onset precisely, and can say what he was doing at the exact moment. Shoulder-tip pain is far more common with perforated ulcer than with pancreatitis. Distension of the upper abdomen is found earlier in pancreatitis than in perforated peptic ulcer.

High intestinal obstruction is associated with pain in the epigastric or umbilical zone, which, although continuous as in pancreatitis, has also a spasmodic or intermittent colicky quality which is not felt in acute pancreatitis. The vomiting is more urgent than in pancreatitis and soon goes on to effortless regurgitant vomiting, whilst the vomit consists first of bile, then small intestine contents, and finally becomes stercoraceous.

Thrombosis or embolism of the superior mesenteric artery may present a difficult diagnostic problem. There may be a profound circulatory collapse highly suggestive of pancreatitis, but the pain has a more intermittent

colicky quality and before long melæna will probably appear and make plain the nature of the trouble.

Coronary thrombosis may, although rarely, simulate acute pancreatitis, but cyanosis in this disease is apt to be more extreme than in pancreatitis, and as a rule the pain is rather substernal than epigastric.

Spontaneous rupture of the common bile duct, when a small diverticulum in the duct gives way, leading to widespread infiltration of the lesser and great omenta with bile, is a rare complication of gall-stones, and produces a clinical picture that may well be indistinguishable from pancreatitis until laparotomy discloses the true cause of the symptoms.

In any of the above conditions, when it is found difficult to exclude the possibility of acute pancreatitis, estimation of the amylase content of the urine or the blood should be carried out. In cases of pancreatitis it will usually be raised to a very considerable extent in the early days of the attack.

MORTALITY AND TREATMENT

Acute pancreatitis in its most severe form is hardly compatible with life. When the whole gland or the greater part of it has undergone massive hæmorrhagic necrosis, if the patient does not die from the initial shock a profound toxæmia is caused by the absorption of toxic products of tryptic activity in the tissues, and by the secondary bacterial invasion and intestinal paralysis. Under such conditions it is hardly conceivable that any form of treatment can save the patient's life. But this applies only to the fulminating cases in which practically the whole pancreas undergoes necrosis. In the milder cases, which constitute the majority, the position is by no means so hopeless.

It was formerly taught, and still is in some quarters, that the right treatment for all cases of acute pancreatitis is early exploration and drainage, and the importance of early surgical interference was stressed with almost as much urgency as in cases of perforated peptic ulcer or acute intestinal obstruction. In recent years a more critical consideration of the problem has, however, brought about a much more conservative attitude. The two considerations that have caused this change of mind have been the high mortality that follows indiscriminate early operation, and the sense of futility the surgeon had when he had explored and found acute pancreatitis. When the whole gland, or even a considerable part of it, is in a state of massive necrosis, it is not possible by any surgical measure to provide drainage that will materially aid the patient's powers of recovery. It is not the blood-stained fluid in the peritoneal cavity that is the danger, but toxic absorption from the sloughing pancreas, and to put a tube down to, or even into the substance of, the inflamed pancreas, does not diminish that toxic absorption to any material extent. Nor can it be said that drainage of the common bile duct or of the gall-bladder will help matters. Even in the rare case when

a stone is impacted at Vater's ampulla the damage is already done, and removal of the stone, which is a matter of extreme technical difficulty in the presence of acute pancreatitis, will not cause a sloughing pancreas to resolve.

There is an increasing weight of statistical evidence in favour of the more conservative methods of treatment. To quote two examples only:—Walzel (1934) collected a series of 30 cases from the years 1926-28 in which early operation was performed, with a mortality of 86 per cent., and contrasted them with a series of 46 cases in the years 1929-34 in which later intervention only was employed. In these the mortality was 28 per cent. Lampson (1942), in an account of 28 cases, found that immediate operation gave a 33 per cent. mortality, whilst in those cases treated either by delayed operation or by non-operative treatment the mortality was only 5 per cent. It is difficult to resist the conclusion that indiscriminate early operation has, in the past, helped to increase the mortality in this disease, in which the mortality must always be considerable. If a surgical exploration achieves no positive object comparable with the closure of a perforating ulcer or division of a strangulating peritoneal band, it is bound to have a harmful effect, if only by increasing the stimulation of the splanchnic inhibitory nerves, and hence the tendency to paralytic ileus.

The whole question of surgical exploration in the early stage of acute pancreatitis is bound up with the problem of diagnosis. As we have already seen, the diagnosis is tolerably easy in the more severe cases, and when the clinical evidence is supported by an increase in the urinary diastatic index, operation should be avoided and support of the patient's depleted circulation concentrated upon. Continuous intravenous saline or plasma is the most important measure. There is some ground for believing that intravenous glucose may be dangerous.

Rich and Duff (1936) reported the case of a girl of thirteen who developed fatal acute hæmorrhagic pancreatitis after treatment by copious infusions of glucose for severe burns, and they quote Babkin's experimental finding (1935), that a raised blood sugar causes an increased flow of pancreatic juice rich in ferments.

When vomiting and distension are severe a Ryle's tube should be passed and continuous gastric suction employed. Morphine must be given in full doses when once the diagnosis is regarded as established, but not before. In a severe case of acute pancreatitis the pain is often very resistant to morphine or any form of sedative. Penicillin intramuscularly or sulphamezathine intravenously will help to control the bacterial invasion. Although this invasion is probably secondary to the necrosis, the toxæmia resulting from it contributes largely to the fatal issue in cases that do not recover.

In those patients who can be kept alive for the first few days and in whom necrosis of the gland is considerable, abscess formation is to be expected. It will be shown by a mounting temperature, leucocytosis and increased epigastric swelling. At this stage surgery has a real contribution

to make, and a timely incision and drainage of the abscess may prove a life-saving measure.

In the less severe cases diagnosis is more difficult and exploratory operation may be necessary. It is better to explore the abdomen of a patient with pancreatitis, even though it is necessary to beat a retreat on discovering the characteristic blood-stained fluid in the peritoneum and fat necrosis in the omentum, than to treat an acute intestinal obstruction or perforated duodenal ulcer on expectant lines. It is not wise to lean too heavily on the diastatic index in making this decision. Such laboratory aids to diagnosis must always be subordinate to the clinical evidence.

PROPHYLACTIC MEASURES

Since gall-stones constitute the most important predisposing cause of this disease it is obvious that the earlier recognition and removal of gall-stones afford the most promising means of its prevention. It might be urged that since gall-stones are very common and acute pancreatitis rare, it is not well to be greatly influenced by this consideration. But granted that pancreatitis occurs only in a very small percentage of patients suffering from gall-stones, it must nevertheless be considered along with the risk of carcinoma of the gall-bladder, another rare sequel of gall-stones, and of obstructive cholecystitis or obstruction of the common duct by impacted stones. All these possibly disastrous results of gall-stones combine to form a strong argument in favour of their surgical removal without undue delay in all patients whose general condition does not render such an operation unwarrantably dangerous.

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Some features brought out by a recent survey of perforated ulcer carried out in Glasgow (Illingworth *et al.*, 1944) throw light on this problem. In this survey, which related to over 7,000 cases treated during a twenty-year period, it was noted that the incidence of perforations is not regular but varies at different periods of the year, on different days of the week and even at different hours of the day. Perforations occur much less commonly in the months of August, September and October than in other months, they occur less commonly on Sundays and Mondays than on other days, and they occur less commonly during the night and morning than at other times of the day. These observations, whilst individually they may be attributable to many factors, when taken together would appear to indicate that physical fatigue plays a more important part than has been supposed, and, conversely, that rest or relief from strain—the holiday season, the weekend, the night's repose—tends to arrest the process which leads to perforation.

PATHOLOGICAL FEATURES

The great majority of perforated ulcers are situated in the anterior wall of the duodenum just beyond the pylorus. Posterior ulcers rarely perforate owing to the ease with which they adhere to adjacent viscera, particularly the pancreas. Gastric perforations are less common than duodenal (in the proportion of one to seven), but are more dangerous, for they are usually larger and permit greater leakage of contents into the peritoneal cavity.

The fluid escaping from the perforation, whether gastric or duodenal, is highly irritant but only mildly infective. Consequently, the peritoneal inflammation which follows is at first a reaction to chemical irritation, and it is only after a lapse of a few hours that true bacterial peritonitis sets in. It is for this reason that early treatment is so imperative. Moreover, this early absence of infection is a guide to the correct operative treatment, for it indicates that at this stage drainage is unnecessary; if the perforation is sealed and the irritant fluid evacuated the natural resistance of the peritoneum is fully adequate to cope with the relatively mild bacterial contamination.

DIAGNOSIS

The symptoms and signs of the usual type of acute perforation are highly characteristic. The sudden onset of intense pain, at first epigastric but rapidly spreading over the whole abdomen, the constant character of the pain and the board-like rigidity of the abdominal muscles, leave little doubt as to the diagnosis. Biliary and renal diseases are distinguished by the site and radiation of the pain; intestinal obstruction by the colicky nature of the pain and the repeated and increasingly offensive vomit; coronary thrombosis by the cardiovascular manifestations and particularly the fall in blood pressure. In the less severe types of perforation, on the other hand, when a minute leak has occurred or when a perforation has been plugged by

PERFORATED PEPTIC ULCER

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At the present time in Great Britain each year between 9,000 and 10,000 persons sustain a perforation of a peptic ulcer. More than 1,000 persons die as a direct result of the perforation, whilst a further 200 die subsequently as a result of later complications of the ulcer. Perforated peptic ulcer is thus both a common and a dangerous disease; it ranks second only to appendicitis among abdominal emergencies, and it is far more important than appendicitis, both in respect of its immediate danger and its long-term end-results. When it is added that in perforated ulcer more than in any other surgical emergency success in treatment is strictly proportional to the speed and accuracy with which the diagnosis is made, it will be seen that the subject is one which merits the closest attention of all medical practitioners.

HISTORICAL SURVEY

Perforation has not always been so common as is indicated above. Indeed, until towards the end of last century it was a somewhat rare disease, although well recognized in view of the suddenness of its onset and the inevitability of its result. During the past fifty years, however, there has been a great change, and hospital records for this period have shown an almost yearly progressive increase in the number of cases treated. This change in incidence coincided with the introduction of surgical treatment, and doubtless much of the apparent increase in frequency must be ascribed to better diagnosis and readier recourse to hospital. Even allowing for such factors, however, there seems to be little doubt that perforation has in fact become much more common than formerly.

The type of patient affected also appears to have changed. Until fifty years ago the majority of recorded perforations occurred in women, particularly in young women, and the medical literature of that time contains many reports dwelling on the tragic character of the disease, as it affected apparently healthy girls in the early twenties or even younger. Nowadays, however, perforation is predominantly a disease of men, and it may occur at any time of life from adolescence to old age.

The reason for these changes is obscure. It is fashionable to ascribe the increasing incidence to psychological causes associated with the heightened tempo of modern life, and support for this view would seem to be given by the greatly increased incidence which was noted in the anxious days of 1940 and 1941. Yet it should be noted that in all probability the worries and anxieties which beset the average working man to-day are no more, if indeed not less, than a hundred years ago; and that certainly the worries and anxieties that beset women have shown no relief to account for their relative freedom from perforation.

and in the face of clinical evidence a negative finding does not justify the withholding of operation.

Whereas in the great majority of perforations the diagnosis can be made with great readiness, there is a small minority in which an element of doubt must remain. In these latter cases it is important to balance the probabilities and "back the winner". A perforation is twenty times more common than pancreatitis and several hundred times more common than a gastric crisis of tabes, and, whereas to avoid operation in a case of gastric crisis is doubtless praiseworthy, to miss a perforation is lamentable.

THE URGENCY OF TREATMENT

It is common knowledge that the longer operation is delayed the greater the risk to life. If operation is performed within six hours the mortality is 10 per cent., with a twelve-hour delay it is 20 per cent., whilst in later cases it rises as high as 50 per cent. It is perhaps not sufficiently appreciated, however, that even within the first six hours, delay is dangerous. It is commonly stated that if a patient is seen immediately after perforation it is better to wait for a time "until the initial shock has passed off". Like so many clinical impressions, this can be disproved completely by the study of exact records of a large series of cases. Such studies show that to operate within four hours is better than six hours, whilst the best results of all are obtained in cases treated within two hours of the time of perforation.

THE OPERATION

There has been much diversity of opinion on whether simple closure of the perforation only should be carried out or whether, in suitable cases, gastrojejunostomy or even gastrectomy should be performed. The argument for the latter course is that, since a considerable proportion of patients treated by simple closure of the perforation continue to suffer severe digestive symptoms, the opportunity should be taken when operating for perforation to perform an anastomosis or resection designed to cure the ulcer. On the other hand, there is the powerful argument that since perforation is a dangerous complication—with an average mortality of something of the order of 10 to 15 per cent.—the main object of the treatment at this time should be to save life. Although it is true that in the hands of experts and in selected cases the addition of gastrojejunostomy or even gastrectomy adds but little to the risk, it would seem wise as a general rule to limit the scope of the operation to the simplest procedure necessary to save life. The only exception is when there is evidence that a considerable degree of stenosis had been present before the perforation, for in such cases gastrojejunostomy is not only advisable as a curative measure but it also improves the immediate prospect of recovery. It should be added, however, that this applies only to severe grades of stenosis, for much of the apparent induration and narrowing of the pylorus seen at the time of perforation is due to acute inflammatory changes and œdema and will subside as the peritonitis resolves.

omentum, the diagnosis may be more difficult. The pain is less severe and may even subside a little, and the rigidity is more localized and less board-like. In such cases, appendicitis, cholecystitis, or even a simple flare-up of the ulcer may cause diagnostic difficulty.

The previous history is often of value. The great majority of patients with perforated ulcer give a history of recurring indigestion, often of many years' duration, and quite commonly there has been a flare-up of the indigestion during the few days or weeks before the onset of acute pain. On the other hand, in 10 per cent. of cases there is no previous ulcer history, and the pain of the perforation comes as a bolt from the blue.

Acute pancreatitis offers the greatest difficulty in diagnosis at the bedside. In its more fulminating forms the deep-seated vice-like pain is just as agonizing and, although there is not usually the typical boarding of a perforation, a good deal of abdominal rigidity may be present. Severe and repeated retching and vomiting point to pancreatitis rather than perforation, but these features may not appear at first, at the time when diagnosis is all-important. In the less acute forms of pancreatitis, when urgency of diagnosis is less pressing, much help may be obtained from estimation of the diastase content of the urine or blood; but these tests are time-consuming and should not be allowed to delay operation when a perforation is suspected.

In *the examination of the patient* it should be recognized that some of the textbook signs, whilst useful enough if their limitations are recognized, are not invariably reliable. Generally the patient lies supine, rigid and immobile and resentful of any attempt to shift his position, but occasionally he finds greater comfort in the lateral position or in moving from side to side, and I have seen one patient who could obtain relief only by sitting bolt upright.

Estimation of the area of liver dullness is an unreliable sign. The liver dullness is certainly quite commonly reduced in perforations, but often the amount of free gas is insufficient to be recognizable by this crude test and, conversely, the liver dullness may be reduced from other causes, such as gaseous distension of the colon. A somewhat more reliable clinical sign is the absence of peristaltic noises on auscultation—the so-called silent abdomen—but even this sign is not invariably present, despite quite a large perforation, whereas, conversely, it may of course be positive in many other acute abdominal disorders.

In doubtful cases valuable information may often be gained by the *X-ray demonstration of free gas* in the peritoneal cavity, and this examination should be carried out in every case in which the clinical symptoms and signs alone are insufficient to justify exploration. For X-ray examination the patient must be placed in the sitting position so that the air will rise to the subphrenic space, and care must, of course, be taken to see that the X-ray film is sufficiently high to include the diaphragm. The demonstration of free gas under the diaphragm is clear evidence of a perforation; it should be recognized, however, that the absence of gas does not exclude a perforation,

The position of the patient.—The Fowler or semi-sitting position is generally advised, with the object of allowing the peritoneal exudate to gravitate from the dangerous subphrenic spaces towards the pelvis. Recently its value in this respect has been assailed, on the ground that fluid collects in the subphrenic region mainly as a result of the negative pressure below the diaphragm and is not influenced greatly by positioning. There is no doubt also that the Fowler position is difficult to maintain and it is probable, moreover, that the "donkey" or bolster under the thighs, which is commonly used for keeping the patient up, carries a certain risk of inducing thrombosis in the leg veins. On the other hand, many patients after an operation on the upper abdomen find the supine position irksome and are able to breathe more freely when propped up. The wisest plan is to study the individual patient, and to support him on pillows in the position of maximum comfort.

Breathing exercises and early movement.—Breathing exercises are of great importance in the prevention of chest complications. As soon as the patient recovers from the anæsthetic he must be encouraged to carry out a full range of respiratory movements. It is not enough merely to advise him to breathe deeply: he must be persuaded, and indeed forced to do so, and every member of the surgical and nursing staff must see that he does so on every possible occasion. The main difficulty is that to breathe deeply stretches the epigastric wound and is painful; this can be reduced by applying 6-inch adhesive strapping over the wound and the lower ribs, to relax the tissues bordering on the wound and to take the strain in coughing.

In addition to breathing exercises, active movements of the whole body should be encouraged as soon as possible, with the special object of preventing thrombophlebitis and also to improve the general body tone. The patient must be encouraged to move his legs from the first and to prop himself up and move from side to side as soon as he is able to do so. In favourable cases he may get his legs over the side of the bed on the third or fourth day, and get up into a chair by the sixth or seventh day.

Gastric drainage.—It is a wise plan to empty the stomach in all cases, and if there is any stenosis or œdema at the pylorus it is useful to maintain constant aspiration of the gastric contents for a few days. The most satisfactory method is to use a no. 10 gastric tube, which can be passed through the nostril and maintained in position for as long as required. It may be passed during the operation, and the stomach emptied by suction, whilst later an electrical pump or other suction device may be used. The patient is allowed to drink freely from the first, not only to assuage thirst but also to moisten the tongue and mouth and prevent parotitis. There is no danger of distending the stomach, as much of the fluid swallowed is evacuated by the suction apparatus.

The use of penicillin.—Penicillin has a recognized value in the treatment of post-operative chest complications, and recent studies appear to indicate

The anæsthetic.—Patients with perforated peptic ulcer are notoriously difficult subjects to anæsthetize. Local and paravertebral anæsthesia is generally unsuitable and few surgeons favour spinal anæsthesia, whilst inhalation anæsthetics have to be pushed deeply to give sufficient abdominal relaxation. Moreover, these patients are often heavy smokers, they are apt to resist during the induction phase and tend to become cyanotic. They are also very liable to post-operative pulmonary complications. For these reasons every effort should be made to obtain the services of a skilled anæsthetist. In the past the choice of anæsthetic has generally fallen on gas-oxygen-ether, although chloroform still has its supporters. It seems likely that in the future the supplementary use of curare will find a valuable place in this type of case.

Technique.—Since duodenal perforations predominate, a right paramedian incision is generally most suitable. When the abdomen is opened, the ulcer is sought first on the anterior wall of the duodenum just beyond the pylorus, and failing that, on the anterior wall of the stomach near the lesser curvature. Rarely a posterior gastric ulcer perforates into the lesser peritoneal sac. If a previous operation for ulcer has been performed, it must be remembered that the perforation may have developed in an anastomotic ulcer.

Great care must be taken to close the perforation securely, for post-mortem examinations show that a common cause of death is continued leakage from a perforation which has been inadequately sutured. Since the tissue immediately bordering on the perforation is often hard and friable, the sutures should be inserted through healthy duodenal or gastric wall some little distance away, and should pick up a sufficient bite of the wall to ensure wide infolding of the opening. Either fine catgut or silk may be used, and generally it is advisable to apply at least two rows of sutures to get close apposition. An omental pad may be applied as a further protection, but reliance should not be placed on an omental patch alone except in very indurated ulcers when other methods of closure have failed.

If much peritoneal exudate is present, it is probably wise to evacuate it either by suction or by swabbing, although by no means all surgeons are agreed about this. Special attention should be paid to the subphrenic and subhepatic spaces as well as to the pelvis. Drainage of the peritoneal cavity is now recognized to be quite unnecessary in cases treated early, say within eight hours of perforation, and its value is very doubtful even in late cases. It is well recognized that drainage of the free peritoneal cavity is quickly rendered ineffective by the formation of adhesions around the drainage tube, and it seems probable in these circumstances that to drain may do more harm than good.

POST-OPERATIVE TREATMENT

The main risks after operation for perforated ulcer are peritonitis and chest complications. The severity of the peritonitis following perforation depends upon the amount and virulence of the bacterial contamination which has occurred previous to operation, and although this can be modified by post-operative care it is largely determined before treatment is begun. The risk of chest complications, on the other hand, can be influenced greatly by proper care in the immediate post-operative period.

Particular attention should be paid to four features of the early post-operative care: (a) the position of the patient; (b) breathing exercises and early movement; (c) gastric drainage, and (d) the use of penicillin.

ACUTE INTESTINAL OBSTRUCTION

BY IAN AIRD, CH.M., F.R.C.S.

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WHEN faced with a patient suffering from, or suspected of suffering from, or presenting any of the symptoms or signs of, acute intestinal obstruction the patient's medical attendant must put to himself a series of questions, and the order with which he answers them, the accuracy of his self-made replies, and the promptness with which he translates his answers into action will be the factors upon which the patient's safety and health depend.

CLINICAL SIGNS

The first question to be asked is "*does this patient suffer from complete or from partial intestinal obstruction?*" There is no single symptom or sign which is conclusive evidence of the presence of an acute obstruction. Colicky pain may occur in a vast number of conditions other than obstructive lesions, and in certain forms of ileus, pain is entirely absent although all other signs of obstruction may be present. Constipation is usual, but even if continued over several days is not evidence of an organic occlusion. The passage of flatus, too, is not conclusive evidence, for sometimes a considerable quantity of gas may be evacuated after a flatus enema in the presence of a complete intestinal obstruction. Vomiting, which may accompany any abdominal condition, may be absent in certain forms of acute intestinal obstruction, notably in some of the more massive strangulations, and the occurrence of faecal vomiting, formerly regarded as of the most helpful significance, is, in most forms of intestinal obstruction, a late symptom and evidence not so much of intestinal obstruction as of culpable delay in diagnosis and treatment. Nor should distention be awaited before a diagnosis is made, for this, too, is a relatively late sign in nearly all forms of obstruction except the paralytic type and certain closed-loop strangulations, such as volvulus. It may be said in general, however, that a patient who has a colicky pain with a complete stoppage of faeces and flatus is under suspicion of acute intestinal obstruction. In such a patient it is nearly always possible to obtain further assistance from physical examination. If distention is present and is shown to be gaseous the likelihood of an obstruction is greatly increased; visible peristalsis, too, present in a distended abdomen is additional supporting evidence, but its absence is not significant and it may occur in the absence of any intra-abdominal lesion in certain types of individual—notably the spare, thinly-covered female.

DIAGNOSTIC MEASURES

Additional and more precise evidence may be obtained in particular forms of obstruction which, by indicating clearly the precise cause of obstruction.

that it may be useful also in their prevention. Since chest complications are particularly common after perforation there would seem to be good reason for the use of penicillin as a routine measure in the immediate post-operative period.

NON-OPERATIVE TREATMENT OF PERFORATION

It is often found that by the time operation is performed the perforation has already been sealed off, either by adhesions to adjacent viscera or by a plug of omentum. This experience has recently prompted the view that operative closure is unnecessary, and during the last year or two a number of cases have been treated by non-operative methods. The routine advised is (1) to give large doses of morphine in order to immobilize the viscera; (2) to empty the stomach and keep it empty by repeated aspiration, in order to prevent further escape of irritant fluid; (3) to give fluids parenterally, and (4) to apply full doses of sulphonamides and penicillin.

Surgeons who have used this method of treatment claim that the results obtained are fully as good as those following operation, but it should be recognized that the method is at present in the experimental stage, and it would be unwise to adopt it as a routine. Possibly further experience will show that it has a place in certain special types of case. In young men, brought for treatment within six to eight hours of perforation, operation carries a low mortality and should doubtless be preferred. In elderly men seen later, on the other hand, since the operative mortality is so high, it may well prove that there is a place for more conservative measures. The most suitable type of case for expectant treatment is the late case seen twelve hours or more after perforation, for at this stage the damage has already been done, diffuse peritonitis is present, to close the perforation is of little avail, and the main indications are for immobilization, the replacement of fluids, and the administration of antibacterial drugs.

END-RESULTS

Few aphorisms are so readily disproved as that which says that "perforation cures an ulcer". In a recent Glasgow survey (Illingworth *et al.*, 1946) relapse had occurred in no fewer than 70 per cent. of cases within five years of operation and in 50 per cent. of cases the relapse was of a severe character. In 20 per cent. of cases a major complication had occurred, such as re-perforation, hæmatemesis or melæna, or symptoms sufficient to call for further operative treatment. The worst results were seen in younger patients, particularly those who gave a long history of ulceration. In view of these observations it is clear that treatment of the perforation must be followed by treatment of the ulcer that has perforated.

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a complete obstruction. This enema may give other information. Blood may be returned in it from certain forms of strangulation, notably occlusive disease of the superior mesenteric artery or vein, and intussusception in the lower reaches of the bowel. A blood-stained result from the diagnostic enema may also occasionally be obtained in the case of volvulus of the pelvic colon, and in cases of obstructing, ulcerating cancer.

ASSESSMENT OF OBSTRUCTION

Once a diagnosis of acute intestinal obstruction is established it is necessary to assess the level of obstruction, the nature of the obstruction, and the likelihood or otherwise of strangulation being present, for these circumstances regulate the "tempo" of the disease and decide the urgency of operative treatment.

The *level of obstruction* is important because upon this depends the degree and speed of dehydration and chloride loss. The higher the obstruction the greater is the loss to the organism of intestinal juices, and the more severe the dehydration, the hypochloræmia, the alkalosis, and the nitrogen retention—the lethal train which is responsible for the mortality of high obstruction. In *high obstruction* particularly, it is necessary to delay operation until lost salt and water have been replaced. The local signs of high obstruction are usually clear. Vomiting is early and copious; distention is slight or indeed absent, and early dehydration is manifest in the patient's sunken cheeks, hollow eyes, parched lips and tongue, dry skin, diminished output of urine, elevated hæmoglobin and red cell count, low blood chlorides, high carbon dioxide combining power, increased alkali reserve and elevated blood urea.

In *low obstruction* of the small intestine vomiting is much later, with onset only after some hours; distention is considerable and centrally placed in the abdomen; and the distended coils may form a ladder-pattern, with or without visible peristalsis. In simple low small intestine obstruction the need for operation is not immediate and any lost fluid and chloride may be replaced while distention is lessened by suction drainage of the upper alimentary tract. Operation may be postponed in most cases for many hours.

In *colonic obstruction* vomiting is late and even in untreated cases may be absent altogether. The distended colon forms a peripheral swelling around the abdomen and any visible peristalsis has a colonic direction. This form of obstruction is usually cancerous. Dehydration and chloride loss are not severe in occlusion at this level and operation should be done relatively early, since the colon cannot be decompressed from above and a grossly distended colon may rupture, so late is the competence of the ileocæcal valve overcome.

THE NATURE OF THE OBSTRUCTING AGENT

The *actual nature of the obstructing agent* can sometimes be deduced or surmised. A strangulated external hernia should be obvious. A scar on the

will coincidentally show that obstruction is present. The presence of an irreducible hernia, tender to pressure and associated with abdominal pain and stoppage of fæces and gas, is as clear evidence of obstruction as could well be required. It cannot be too strongly urged that the first step in physical examination of the abdomen in a patient suspected of obstruction should be the inspection and palpation of all accessible hernia orifices—inguinal, femoral, umbilical, and at the site of an old operation wound, and such rarer sites as the adductor region, the buttock and the loin. Even the most experienced clinician, strongly influenced by a train of symptoms and physical examination typical of some other form of obstruction, may arrive at a diagnosis of intussusception in a young infant, or of gall-stone ileus in a middle-aged woman, when a hernia, unsuspected by the patient's relatives in the one case or by the patient in the other, is the responsible lesion. Similarly, the palpation of an obviously malignant tumour in the abdomen or the detection on rectal examination of an impassable malignant stricture may, in establishing the exact diagnosis, establish also that an obstruction is present.

X-ray examination.—After a complete physical examination, whether the diagnosis is established or is still in doubt, there are two additional manœuvres which are of assistance, not only in confirming the general diagnosis of obstruction but also in deciding its level and nature. The value of a straight X-ray of the abdomen in a case of intestinal obstruction can hardly be overestimated. In an acute intestinal obstruction, coils of distended bowel above the occlusion will be clearly outlined by gas and it will be obvious whether the dilatation affects the small intestine or the colon. If an acute obstruction is superimposed upon the chronic type, not only will loops be distended by gas, but they are likely also to contain fluid and there may be multiple fluid layers visible in the plate, each with a gas-filled dome above it. This method of examination is not without its peculiar fallacies. Sometimes a substantial segment of colon *below* an obstructing tumour may be ballooned to mimic the distention of colonic obstruction. It is not always easy to decide from gas distention alone the actual segment of bowel distended. Colonic distention, if accompanied by ballooning of the rectum obvious on rectal examination, should be regarded with some suspicion. The gas of a ballooned colon distal to an occlusion can be cleared by eserine, given intravenously and supplemented by an enema (Ogilvie), even if an obstruction be present, but the advisability of flogging pharmacologically an overtaxed bowel above an obstruction must always be questioned in deciding whether or not to apply this technique.

The other method of investigation which is of advantage in all cases of obstruction except those in which the cause is obvious, such as strangulated hernia, is the *flatus enema*. The receipt of a "coloured result" or of a "few small scybala" without any return of flatus is strong confirmatory evidence of

may be tenderness when the hand is pressed into the abdomen at the site of the block, but tenderness elicited by raising the examining hand again is present only in strangulation. The tenderness is due to inflammation of the serous coat of the strangulated bowel and in only one form of strangulation is it absent, i.e. acute intussusception, in which the serous coat of the intussusceptum is protected from the examining hand by the sheath.

TREATMENT

So far as the treatment of intestinal obstruction is concerned the most valuable recent advance has been the wide application of suction drainage of the upper alimentary tract (by way of a rubber tube passed through the mouth or nose to the stomach and allowed thereafter to proceed to the upper reaches of the intestine), and appreciation of the general value of replacement of lost water and salt by intravenous infusion of normal sodium chloride solution. It must be realized, however, that these form only one aspect of the management of acute intestinal obstruction and they are curative of only one type, i.e. post-operative ileus. Continued too long in a strangulation they may be responsible for devitalization of the damaged loop; established unwisely in a cancerous obstruction of the colon they may permit perforation of the colon to occur with fatal peritonitis; continued indefinitely in an obstruction due to a band they may permit a strangulation to occur at the site of pressure. In high obstructions, decompression of the bowel by suction and replacement of fluid by intravenous drip should be continued deliberately until dehydration is corrected. In low small intestine obstructions they are almost equally valuable. In colonic obstructions, suction drainage is of little value and dehydration is of small degree; thus quite early operation is desirable. In strangulation, lost fluid should be replaced quickly only while preparations are being made for immediate operation. It perhaps should be added here that in extensive strangulations there is a substantial blood loss from the general circulation which may benefit from transfusion; this is especially true in mesenteric embolism and thrombosis, when the patient may bleed to death from the congested intestinal vessels within a few hours.

Pre- and post-operative measures.—The details of operation have no place in an article such as this, as many of them are highly technical. There are certain general rules, however, which are of advantage. Pre-operative suction drainage of the stomach and upper bowel greatly reduce the foul vomiting which used to occur at the end of operation and gave rise to septic pneumonia and other formidable pulmonary complications. Indeed, so well is vomiting now controlled by suction that a general inhalation anaesthesia is quite practicable if it should be desired. There are certain disadvantages attached to spinal anaesthesia which are more than theoretical, for the mortality of patients with acute obstruction is not lessened and may possibly be increased by the general use of the spinal form. When spinal

abdomen suggests an adhesive form of obstruction. A clinical history of intussusception and of volvulus is characteristic, and the sausage-shaped swelling of an intussusception, no less than the enormous but localized ballooning of a volvulus, is unmistakable. A simple occlusion of the colon is likely to be due to malignant disease and the responsible tumour may be either tender or palpable, through the abdomen or from the rectum. The sudden onset of obstructive signs with early collapse in a patient with cardiac or peripheral vascular disease may raise a suspicion of mesenteric embolism or thrombosis, and this may be verified by the passage of blood or by a blood-stained result from a diagnostic enema. Obstruction early after operation, or recurrence of obstructive signs after operation for the relief of obstruction, is likely to be due to paralytic ileus, and here the diagnosis is established by the painlessness of the distention and the silence of the abdomen on auscultation.

The age of the patient may give a hint of the cause of the obstruction. In a new-born baby, obstruction is likely to be due to some form of atresia. In an infant a few days old the onset of obstruction suggests volvulus neonatorum. In a boy a few months old an acute intussusception would be suspected, a condition which, of course, presents a characteristic clinical picture. In older children tuberculous peritonitis is a common cause, and strangulated hernia a rare cause of obstruction. In young adults, again, strangulated hernia, external or internal, may be responsible, or adhesions after an appendix operation. In and beyond middle age, carcinoma is the most likely cause of intestinal obstruction, although in a middle-aged woman with a history suggestive of cholecystitis, gall-stone ileus may be suspected, and proved by a straight X-ray.

Of highest importance in deciding whether to operate immediately or whether to temporize while lost fluids and salt are replaced by infusion, and distention relieved by suction drainage, is the decision *whether the obstruction is a simple occlusion or a strangulation*. In the former, operation is not immediately urgent; in the latter, operation must be done at once to avoid the risk of increasing devitalization of the affected bowel loop. That the cause of obstruction is strangulation may be obvious from a typical clinical picture such as that obtained in strangulated external hernia, in intussusception, in volvulus and mesenteric thrombosis or embolism, but in such strangulations as those due to internal hernia it may not be so easy to decide whether strangulation is present or not. Sudden, overwhelming, continuous and increasing abdominal pain is rather suggestive of a strangulation but is by no means exclusive to that form of obstruction. The passage of blood from the bowel soon after the onset of obstruction is almost certain evidence of strangulation. A severe degree of initial "shock" also suggests that blood has been lost into strangulated bowel and into the peritoneal cavity. But one sign, so-called rebound tenderness, is diagnostic of the presence of a strangulated loop of bowel. In any obstruction there

BILIARY AND RENAL COLIC

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THE colics are episodes of paroxysmal abdominal pain of great intensity, wholly justifying the use of the word "agony", especially if used in its older sense of "extreme bodily suffering with throes or writhing" (O.E.D.). The pain is caused by the contraction of one of the involuntary muscular tubes, such as the biliary apparatus or ureter, in its efforts to overcome an obstruction, be it organic, as in cases of calculus, growth or extrinsic pressure, or from purely functional disturbances such as spasm or achalasia.

The colics present certain features in common which help to distinguish them from other severe pains within the abdomen. They are paroxysmal, each paroxysm mounting to a peak of great intensity followed by a subsidence which may be gradual or at times abrupt. They are associated with much anguish of mind and restlessness of body, and usually leave in their wake a soreness and tenderness of the muscles, as if bruised. The pain has a twofold reference, partly and often somewhat vaguely to its site of origin and partly and more accurately to the area of nerve distribution from the appropriate spinal segment. Associated with the attack is evidence of stimulation of the sympathetic nervous system giving rise to a variable degree of shock, and such symptoms as pallor, subnormal temperature, feeble pulse, sweating, chilling of the body surface, often with shivering, and vomiting.

BILIARY COLIC

It is unfortunate that the term "biliary colic" should so often be regarded as synonymous with the passage or attempted passage of a gall-stone through the biliary ducts, as such a conception overlooks other important causes. The gall-bladder, cystic duct, common bile duct and ampulla of Vater with the sphincter of Oddi constitute a physiological unit, contraction of the gall-bladder being associated with relaxation of Oddi's sphincter and the discharge of bile from the ampulla. This mechanism is normally activated by cholecystokinin, a hormone derived from the interaction of fat or fatty acid with the duodenal mucosa, and its functional integrity may be affected in a number of ways, giving rise to biliary tract pain, of which colic is the most dramatic and severe example. Biliary colic arises most commonly from the passage, or attempted passage, of a stone or inspissated bile, and less commonly from spasm or achalasia of Oddi's sphincter in certain cases of acute cholecystitis and after the operation of cholecystectomy, when for a time the function of the sphincter is in abeyance. A much rarer cause is an abnormal position of the cystic duct or the cystic artery leading to kinking with the gall-bladder in certain positions, a condition analagous to the occurrence of Dietl's crises in a mobile kidney.

anæsthesia is induced, sympathetic inhibition of the small gut is abolished and an exaggeration of tone in the intestinal muscle may occur from uncontrolled evacuant effort. Violent increase of peristalsis in a distended obstructed bowel is in general undesirable, particularly because it results in a squeezing of intestinal capillaries whose blood, loaded with material shown to have certain depressor properties, may be returned suddenly to the general circulation. Therefore there is now in many quarters a preference for the use of general anæsthesia instead of spinal at operation for the relief of obstruction. This objection does not apply to paralytic forms of obstruction in which the encouragement of peristalsis by the induction of a spinal anæsthetic may be beneficial if spontaneous deflation does not occur in the course of suction drainage.

After operation, nasal suction drainage and intravenous saline should be continued until normal bowel evacuation is re-established. A considerable part of the mortality of intestinal obstruction, which still remains at 40 per cent. if strangulated hernia is excluded, is due to paralytic ileus continuing in the previously distended bowel. If the obstruction has been removed at operation this can well be prevented or controlled by a suction and infusion regime. This measure will be of benefit also to patients in whom not a paralytic ileus, but a spastic ileus of that segment of the bowel which has been the actual seat of obstruction is responsible for progressive distention after operation.

No article on intestinal obstruction would be complete without at least one reference to the potential danger of gastro-intestinal suction drainage. This can dehydrate the patient even more rapidly than vomiting can, and suction should never be employed unless fluid and salt are replaced by intravenous infusion carefully controlled by a fluid balance sheet, the credit side of which is the amount of fluid taken by mouth and intravenously, and the debit side a record of the volume of fluid withdrawn by suction together with the volume of urine passed and the estimated "insensible" loss of fluid by perspiration and respiration. Such a balance sheet is more valuable as a guide to dosage of intravenous fluid than direct and elaborate investigations of the blood chemistry.

CONCLUSION

In summary it may be said that the first essential when presented with a patient exhibiting the symptoms of intestinal obstruction is to establish the diagnosis of obstruction; the second, to decide at what level the obstruction lies; the third, to conjecture or deduct the actual cause of obstruction; and the fourth, to distinguish between strangulation and occlusion. When these are decided the tempo of treatment may be synchronized with the tempo of the disease, and a happy balance may be struck between the attention given to fluid replacement and suction drainage on the one hand, and operative intervention on the other.

to attacks of colic for reasons already mentioned and, in the absence of a positive demonstration of a calculus on a straight X-ray film or the negative shadows seen in a cholecystogram, a differential diagnosis may be impossible.

Biliary colic without stones may follow removal of the gall-bladder for calculi or for cholecystitis, and may give rise to a suspicion that stones have been left behind in the common bile duct. It is probable that such attacks are due to disturbance of the neuromuscular control of the biliary apparatus. In cholecystitis the common bile duct often dilates to form a reservoir, and resistance is offered to its contractions by the unrelaxed Oddi's sphincter. With appropriate medical treatment and the passage of time, normal function is ultimately restored. The occurrence of an abnormal cystic duct or angulation produced by an abnormal cystic artery may be revealed by a cholecystogram, but more often is diagnosed only at laparotomy.

THE DIFFERENTIAL DIAGNOSIS OF BILIARY COLIC

Biliary colic has to be distinguished from other acute attacks in the upper abdomen and region of the diaphragm. The most important of these are:—

- (1) Diaphragmatic pleurisy and acute lobar pneumonia
- (2) Perforation of a peptic ulcer
- (3) Angina pectoris
- (4) Cardiac infarction
- (5) The gastric crises of tabes dorsalis
- (6) Acute pancreatitis

(1) *Diaphragmatic pleurisy and acute lobar pneumonia.*—The differential diagnosis between a lower thoracic and upper abdominal lesion always requires the most careful consideration. The pain of pleurisy which involves the diaphragm may be very severe, but it is essentially inspiratory in its incidence, has none of the paroxysmal features of colic and is unattended by restlessness. Signs in the chest are often absent at an early stage, but the respirations are thoracic in type, shallow and accompanied by grunting and movement of the alæ nasi. The temperature will be raised. Involvement of the diaphragm usually produces some degree of rigidity and tenderness of the upper abdominal muscles. Shoulder-tip pain is often present—a reference from the phrenic nerve through the fourth cervical segment—and although this sign may occur in biliary colic, it is rare and is much more significant of diaphragmatic pleurisy or of perforated peptic ulcer. An X-ray film of the chest may aid the diagnosis.

(2) *Perforation of a peptic ulcer.*—Although a lower right-sided thoracic lesion provides the most difficult problem in diagnosis, a perforated peptic ulcer is certainly the most important and calls for immediate solution. The pain, sudden in onset and of great intensity, is usually localized in the epigastrium, but with the escape of gastric contents may rapidly extend downwards so as to involve the entire abdomen. The muscles are board-like in their rigidity and very tender. Irritation of the diaphragm results in phrenic

Cholesterol, the principal constituent of 75 per cent. of all gall-stones, is held in solution by the bile acids and begins to be deposited when the normal cholesterol/bile acid ratio of 1 to 20 falls below 1 to 13. This may occur under any of the conditions which give rise to stasis in the biliary tract. Of these the chief are obstruction to the outflow of bile, acute cholecystitis and pregnancy. Under these conditions it is believed that the bile acids are absorbed more rapidly than cholesterol, which may then be deposited. There is no good scientific evidence to associate gall-stones with a high level of blood cholesterol. The importance of pregnancy as an etiological factor in the formation of gall-stones has probably been exaggerated, and Davidson (1944), in a valuable account of their formation, produced evidence that the incidence is one of sex rather than pregnancy.

The attack.—Biliary colic may occur at any time, but a common time is in the early hours of the morning, the usual explanation of this being that the principal meal of the day and the chief fatty meal is often taken in the evening. It may, however, occur after any meal or after some unusual exertion. The pain occurs with great suddenness and rapidly reaches such a peak of intensity as to make the patient cry out and writhe in agony. It may be localized in the right hypochondrium or in the epigastrium, and there is often a reference to the back under the angle of the right scapula, the area supplied by the eighth dorsal segment of the spinal cord. The usual features of colic are present: great restlessness, in which the patient tries vainly to find a position which will give him ease, and evidence of shock from profound stimulation of the sympathetic nervous system. The temperature is usually subnormal unless there is an accompanying cholecystitis.

The signs include moderate rigidity of the upper abdominal muscles during the paroxysm and relaxation between the spasms. Tenderness is present in the region of the gall-bladder although the associated rigidity prevents accurate palpation. The respirations are usually thoracic in type and shallow. Inspiration is often painful and may result in a characteristic grunt. The duration of the attack varies from a few minutes to several hours, and may wax and wane in intensity, relief coming suddenly, as when a stone, impacted in Hartman's pouch, falls back into the gall-bladder; or dying away gradually, leaving the abdominal muscles sore for several days. Jaundice of obstructive type occurs when a stone is impacted in the common duct or in Vater's ampulla.

The diagnosis of biliary colic due to calculus is usually not difficult. There is often a history of dyspepsia due to reflex pylorospasm, the so-called gastric mask of gall-bladder disease. It takes the form of discomfort or pain with a variable relation to meals, sometimes closely simulating ulcer pain. Flatulence and belching, however, are prominent features, and vomiting may occur. Gall-bladder dyspepsia is evidence of gall-bladder infection, and is absent in those cases in which a single cholesterol stone occurs in a sterile gall-bladder. It must be remembered that acute cholecystitis may give rise

arrhythmia, especially auricular fibrillation, may be present. A considerable and immediate fall in blood pressure is evidence of a myocardial lesion rather than of biliary colic.

(5) *The gastric crises of tabes dorsalis.*—These take the form of sudden attacks of very severe abdominal pain and vomiting, with complete anorexia. They may last a few days or a week or two and may be repeated at short intervals for a long period. Gastric crises may occur as the earliest symptom of tabes dorsalis, but diagnosis should present no difficulty, provided attention is paid to sensory impairment and the ankle-jerks rather than to the knee-jerks and pupils.

(6) *Acute pancreatitis.*—Acute pancreatitis is most often mistaken for a perforated gastric or duodenal ulcer and often enough laparotomy alone will settle the diagnosis. There may be a history of gall-bladder disease with attacks of jaundice. The onset is usually of dramatic suddenness with excruciating pain felt in the epigastrium and in one or both loins. Phrenic pain is uncommon. The patient lies immobile in his distress. Shock is profound and vomiting or retching constant. Tenderness is felt in the epigastrium rather than the right hypochondrium, but rigidity is inconstant. Jaundice is found in about half the cases, and cyanosis, especially of the face and extremities, has been noted in a considerable number. Glycosuria is an occasional finding and the urinary diastase may rise from the normal level of 10 to 20 units to over 200.

THE TREATMENT OF BILIARY COLIC

(1) *The attack.*—Morphine in full doses, $\frac{1}{4}$ to $\frac{1}{2}$ a grain (16 to 32 mgm.), should be given as soon as the diagnosis of biliary colic is established, and repeated if necessary. It is doubtful if the addition of atropine has any further advantage. On the other hand, drugs which relax plain muscle, such as the nitrites and xanthins, although acting feebly alone, may enhance the value of morphine, since morphine occasionally causes spasm of Oddi's sphincter, and in anything less than full doses may aggravate rather than relieve. Nitroglycerin, 1/100 of a grain (0.65 mgm.), sublingually and aminophylline (theophylline with ethylene diamine), 0.24 gm. in 10 c.cm. of sterile water, intravenously, have been shown to be effective experimentally in overcoming the spasm produced in the biliary tract in human beings by morphine and codeine (Goodman and Gilman, 1941). The chief action of morphine, however, is central and it is most valuable in preventing shock. In addition to these remedies, the great value of heat locally applied must not be overlooked.

(2) *After-treatment.*—The patient who has been through an attack of biliary colic should remain in bed until all pain, local tenderness and jaundice, if present, have gone. This usually implies at least a week in bed.

pain referred to the top of one or both shoulders, the supraspinous fossa, tip of the acromium process or over the clavicle. Shock may be extreme, with anxious expression, small weak pulse, subnormal temperature and cold extremities. The rigid stillness of the patient is in marked contrast to the restlessness of colic. The respirations are thoracic, shallow and often painful, the abdominal muscles immobile. Tenderness may be elicited on rectal examination when the pelvic peritoneum is irritated by escaped gastric contents and inflammatory exudate. This sign, however, is not always present, especially in the first hour or two after perforation has taken place.

Examination for free gas in the peritoneal cavity should always be made, as its presence is diagnostic of a perforation. Percussion over the anterior surface of the liver gives uncertain results and resonance here may be due to the upward displacement of distended intestines, especially if associated with general abdominal distension. Percussion over the liver in the anterior axillary line is the method of choice, and to quote Zachary Cope (1940): "When in any acute abdominal case distinct resonance be obtained over the liver in the mid-axillary line about 2 in. or more above the costal border, one is certainly dealing with a perforation of a gastric or duodenal ulcer." If X-ray examination is available, a skiagram is the simplest method of demonstrating a collection of gas below the diaphragm. If, however, the stomach is empty at the time of perforation, the leak small and rapidly sealed off and the escaped fluid localized to the upper abdomen, the difficulties of diagnosis may be much greater.

(3) *Angina pectoris*.—Severe pain arising in the myocardium is occasionally referred to the lower sternum and epigastrium, so as to simulate an abdominal rather than a thoracic emergency. It must be remembered, too, that angina and biliary colic may coexist in the same individual. Little difficulty should arise if a careful history is taken. The strict relation of the pain to exertion, the reference to one or both arms, its prompt relief by nitrites and the immobility of the patient during the attack, serve to identify the angina of effort.

(4) *Cardiac infarction*.—In the case of cardiac infarction the diagnosis of a typical attack is rarely in doubt. Occasionally the pain is predominantly epigastric and may be accompanied by some rigidity and tenderness, and often by nausea and vomiting. Moreover, like biliary colic, it may wake the patient in the early hours of the morning. The pain, however, is continuous rather than paroxysmal, such waves of variation as it may show having a much longer pitch and a lower intensity than those of biliary colic. Furthermore, it does not respond to the administration of nitrites and may yield to morphine only after repeated doses. Restlessness is often a feature of coronary thrombosis but there is none of the writhing of the patient in the throes of a colic. Shock may be profound in both states, but in coronary thrombosis there is often a waxy pallor tinged with grey, and dyspnoea with signs of right- or left-sided cardiac failure; and often some form of

- (3) Inspissated material
 - (a) Blood clot
 - (b) Pus
- (4) Kinking of the ureter by
 - (a) Mobile kidney
 - (b) Aberrant renal vessel

The passage, or attempted passage, of a small calculus is much the most frequent cause of renal colic. The most common forms of calculi are those composed of calcium oxalate or carbonate, uric acid, urates, phosphates or a mixture of these. Their deposition as stones will depend upon their solubility in the urine according to its pH, the presence of urea which renders uric acid and oxalates more soluble, and on the availability of some colloidal material to bind them together. Thus calcium oxalate, which excites albuminuria and at times hæmaturia, is the most common nucleus of a renal calculus.

The etiology of calculus formation is still obscure and a full discussion of what is at present largely speculative would be outside the scope of this article. It must suffice to state that dietetic, infective and physio-chemical agencies play a part in the genesis of stone. Its frequent occurrence in tropical climates suggests that urinary concentration from dehydration plays an important rôle. McCarrison has shown that a diet rich in calcium favours stone formation, and a high blood calcium resulting from vitamin D deficiency or excess of parathormone in parathyroid tumours is an important factor in producing calculi of calcium phosphate. Lack of vitamin A, which is concerned with the nutrition of epithelium throughout the body, may result in desquamated keratinized epithelium to form the nuclei of stones. It is stated (Langdon-Brown and Evans, 1941) that 96 per cent. of cases of renal calculi show such deficiency.

The part played by infection is contributory rather than primary, otherwise it is clear that the incidence of stone would be much higher. Stagnation of the urine in such conditions as prolonged recumbency, hydronephrosis, pyonephrosis and stricture of the ureters, favours the deposit of salts, whilst superadded infection accelerates the process.

No age is exempt, and males are more prone to calculus formation than females.

The attack.—The pain, which has the usual features of colic, and is often precipitated by jolting, may be of a greater intensity than that in any other form, the sufferer writhing in an agony which may bring him to his knees in his attempts to find relief. It is felt somewhat vaguely and deeply in the loin and is referred to the areas supplied by the first and second lumbar segments, the groin, the testicle or vulva anteriorly and the region just above and below the iliac crest behind, although this reference is not always complete. The testicle may be retracted. Symptoms of shock will probably be severe. The referred pain of renal colic may be reproduced with exact

During this period the diet should be of the lightest, and chiefly carbohydrate in easily assimilated form. All fats should be avoided, owing to the risk of precipitating biliary activity and a further attack of colic through the agency of cholecystokinins. Subsequently, when all evidence of acute inflammation has subsided, fat in the form of milk and olive oil may be employed with advantage, as it stimulates the flow of bile and encourages drainage of the biliary passages. For similar reasons cholagogues have their place at this stage. Of these the most effective is decholin (N.N.R.) and decholin sodium (N.N.R.) (preparations of dehydrocholic acid and its sodium salt), 4 to 8 grains (0.25 to 0.5 gm.), two or three times daily with meals. Contrary to what has usually been taught there seems to be no sound reason for withholding such foods as eggs, brains, sweetbreads, liver, cream, suet and others which contain cholesterol. The association of gall-stones and hypercholesterolaemia is by no means clear. Experiments have been carried out (Gough, 1943) using high and low cholesterol-containing diets without noticeably influencing the level of the blood cholesterol. The hen continues to lay admirable eggs when deprived of cholesterol, and the deposit of cholesterol in the gall-bladder seems to depend more upon the cholesterol/bile acid ratio in the bile than the concentration of cholesterol in the blood.

(3) *The place of surgery.*—Operation should be avoided during the stage of acute inflammation, and only in the case of perforation or empyema of the gall-bladder does it become imperative. Subsequent decision to operate must depend upon a number of factors, such as the persistence of attacks of colic or cholecystitis with dyspepsia, the age and general condition of the patient. Gall-stones and chronic cholecystitis are not in themselves necessary indications for surgery; they may yield to careful and prolonged medical management, but it is fair to point out that at best they imply some prolonged curtailment of normal activity and strict attention to diet, and at worst some injury of the liver from prolonged biliary sepsis and perhaps some damage to the myocardium. The risk of cancer is so slight, occurring in only about 4 per cent. of cases with gall-stones, that it should not be advanced as an argument for surgery. Finally, it may be remarked that elderly patients with gall-bladder disease usually stand operation well.

RENAL COLIC

Renal colic is brought about by violent contractions of the ureter in its attempt to overcome an obstruction. The chief causes are as follows:—

- (1) Calculus
- (2) Debris
 - (a) Uratic
 - (b) Phosphatic
 - (c) Oxalate crystals
 - (d) Sulphonamide acetate crystals

growth or other cause in the pelvic colon. Colon spasm may occasionally give rise to sudden pain of great intensity and be attended by severe vaso-vagal disturbance leading to syncope. Great restlessness is absent and pain is not referred to the testicle or vulva. The colon can occasionally be felt contracted and tender in the left iliac fossa, but there is no tenderness in the loin nor rigidity of muscles, and vomiting is rare. A history of bowel disturbance will usually be obtained and mucus may be seen in the stools, occasionally in the form of casts. In colon neuroses emotional instability is common. In allergy a food factor may be recognized. In acute diverticulitis associated with spasm, a tender sausage-shaped tumour may be felt in the left lumbar or iliac region or a tender mass in the pelvis on rectal examination. The temperature is raised and blood and mucus may be present, or there may be complete obstruction to faeces and flatus. In other forms of lower colonic obstruction the proximal loops of bowel are distended, and waves of peristalsis may be seen or felt during the paroxysms of pain.

TREATMENT OF RENAL COLIC

The attack.—A full dose of morphine, $\frac{1}{4}$ to $\frac{1}{2}$ a grain (16 to 32 mgm.), with or without atropine sulphate, $\frac{1}{100}$ of a grain (0.65 mgm.), is a necessity as soon as diagnosis is established. The pain may, however, be of such intensity as to need temporary anæsthesia with chloroform inhalations. The nitrites and aminophylline will give partial relief or reinforce the action of morphine, as mentioned in the treatment of biliary colic. Heat should be applied.

After-treatment.—The patient is kept in bed until the attack has completely subsided and hæmaturia has disappeared. Daily examinations of the urine for pus and blood are desirable. A copious fluid intake of water, barley water, imperial drink or one of the natural mineral waters, up to at least 5 pints in the twenty-four hours, should be assured. If the urine is acid with abnormal concentration of urates, uric acid or oxalates, potassium citrate should be given in doses just sufficient to bring about an amphoteric reaction with litmus. A dose of 20 to 30 grains (1.3 to 2 gm.) t.d.s. will usually prove sufficient. Over-alkalinization of the urine should be avoided, as there is some risk of a deposit of alkaline phosphates. If pain persists, tincture of belladonna, 10 minims (0.6 c.cm.), or tincture of hyoscyamus, 20 minims (1.2 c.cm.), can be added with advantage to the potassium citrate. The combination of a copious fluid intake with an antispasmodic, such as belladonna, may assist in the expulsion of small stones. If the urine is alkaline, small doses of acid sodium phosphate, 10 grains (0.65 gm.) four-hourly, should be given to control the reaction and prevent the further deposit of phosphates. When the acute phase has passed the cause of the attack must be investigated by all available methods—bacterial culture of the urine, X-ray examination of the entire renal tract, pyelograms, intravenous and retrograde, and catheterization of the ureters, as indicated.

accuracy by the injection of the interspinal ligament of the first lumbar vertebra (Lewis, 1942). It remains constant and, contrary to what has usually been described, does not alter its position with the descent of the stone, the reference being from the ureter in its entirety (Lewis, 1942). Some rigidity and tenderness of the muscles are present during an attack which, after a few hours, may subside gradually, or suddenly if the stone escapes into the bladder. Cutaneous tenderness is occasionally present. The kidney may be felt, enlarged and tender, hæmaturia is common, and there may be pain on micturition. Calculus anuria may occur if the opposite kidney is the seat of a stone or its secretion reflexly suppressed.

Blood clot from a growth of the kidney and inspissated pus in acute pyelitis may occasionally cause attacks of renal colic. In oxaluria, showers of oxalate crystals promote attacks of colic which are bilateral, and similar paroxysms have been described in patients undergoing treatment with one of the sulphonamides. The attacks are due to the deposition of crystals of sulphonamide acetate and are especially liable to occur when the fluid intake is inadequate. Dietl's crises of renal pain occur when the ureter is suddenly kinked at its junction with the renal pelvis by an unduly mobile kidney or an aberrant renal artery. Hæmaturia is usually a feature and an intermittent hydronephrosis may follow.

Diagnosis.—Renal colic and hæmaturia suggest stone, but may be due to the passage of blood clot from a new growth or to pus in acute pyelitis. X-ray examination is usually most valuable. Oxalate stones, the most common form of calculus, throw a dense shadow. On the other hand, uratic stones may be invisible. Difficulties may be occasioned by the presence of calcified glands or phleboliths, and in doubtful cases a pyelogram, intravenous or retrograde, should be undertaken. Radiography should always include a film of the pelvis, as the stone may have escaped into the bladder.

Differential diagnosis.—The diagnosis of renal colic with its characteristic pain reference can rarely give rise to confusion, but certain occasional difficulties may be briefly discussed.

On the right side, appendicular colic, especially if the appendix is retrocaecal in position, may need consideration, whilst biliary colic occasionally comes into the picture, especially as the great pain and restlessness in each case make accurate local examination difficult. In appendicular colic the pain is central and tenderness localized in the right iliac fossa and rarely in the right loin; the typical restlessness of renal colic is absent, and although pain can occasionally be referred to the testicle, it is certainly unusual, and this organ is not retracted. In biliary colic the pain is always in the upper abdomen and never referred to the groin or testicle. A history of gall-bladder dyspepsia may be obtained.

On the left side, colic or colon spasm may give rise to difficulty. Attacks of colon spasm may arise as spasmodic events in colon neurosis, in gastrointestinal allergy, acute diverticulitis, and more rarely in obstruction from

RHESUS INCOMPATIBILITY

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THE term erythroblastosis foetalis is in current use to cover a large variety of older conditions which in the light of modern knowledge appear all to have a common etiology. An exhaustive list of the synonyms is impossible, but icterus gravis, congenital hæmolytic anæmia, hydrops foetalis, foetal hæmolytic disease and erythronoclastic anæmia are some of the more frequently encountered names. These terms all apply to various clinical manifestations of disease of the newborn, and many cases of macerated foetus should undoubtedly be included with them.

The clinical groups and pathological changes associated with so-called erythroblastosis have been the subject of many excellent papers, notably from Parsons, Hawksley and Gittins (1933), Hawksley and Lightwood (1934) and Gilmour (1944). Only recently, however, has the cause of these allied conditions been worked out and, although the clinical and pathological findings in the older work are mostly unimpeachable, many of the conclusions and much of the suggested treatment must be revised in accordance with the newer conception of the disease syndrome.

Wiener and Peters (1940) first demonstrated the presence of rhesus antigens in the human, and their work was applied to erythroblastosis by Levine, Katzin and Burnham (1941), who showed that some cases, at least, of erythroblastæmia were caused by an incompatibility between the bloods of mother and child. This original work has been much extended by Boorman, Dodd and Mollison (1942), Race, Taylor, Cappell and McFarlane (1943), and many other investigators.

As more families suspected of rhesus incompatibility were examined it became evident that not all the red cell antigens were similar, and succeeding differently reacting cells were accorded distinguishing labels. The rhesus antigen had been abbreviated to Rh, and the subgroups were accordingly labelled Rh₁, Rh₂, Rh', and so on.

NOMENCLATURE

The symbol Rh has been shortened to R, and will be so designated for the remainder of this article, R indicating rhesus positiveness and r rhesus negativeness. The early work of Wiener (1941, 1942) resulted in the recognition of a series of R groups known as R₁, R₂, R₀, R', R'', Ry and Rz. There was also Hr or r, and the agglutinins evoked by these different gene types were simply known as anti-R₁, anti-Hr, and so on. Fisher (1944) clarified the position considerably when he propounded his theory of linked loci being closely apposed on a strip of chromosome. At each locus there are two alleles, C-c, D-d and E-e. Then what is for convenience called a gene

A full discussion of the treatment of renal calculi is outside the scope of this article and the following statement represents a brief summary only.

The diet will need special consideration and will depend to some extent upon the constituents of the calculus, although it must be remembered that most calculi are of mixed composition. In all cases an adequate supply of vitamin A must be secured and the necessity for an abundant fluid intake has already been emphasized. In cases in which stones of uric acid or urates are passed, the amount of animal protein should be cut down, and foods and drinks containing nucleoprotein, such as kidney, liver, sweetbreads and brains, tea and coffee, should be reduced to a minimum. A liberal amount of fruit and vegetables should be prescribed. Excessive concentration of phosphates in the urine calls for the avoidance of calcium-rich foods, such as milk, eggs and vegetables, and a corresponding increase in the amount of meat, cereals and potatoes.

Oxaluria is met with in certain individuals, particularly, it is believed, in those with a high acid gastric secretion, after the ingestion of foods containing oxalates, such as rhubarb, tomatoes, strawberries, spinach and asparagus. These cannot be eaten with impunity by the victims of oxaluria but, according to Lakin (1946), they may be eaten with safety and relish if accompanied by a generous allowance of fat, the oxalate presumably being removed from the alimentary canal in the form of an insoluble calcium soap. Thus strawberries and rhubarb lose their terrors if eaten with cream, spinach and asparagus with margarine or butter sauce; a tribute to the discernment, physiological and æsthetic, of our gastronomic experts.

It is perhaps desirable to emphasize that stones retained in the urinary tract cannot be dissolved by any known medical methods and their removal is a problem for the surgeon.

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Whereas the ABO agglutinins occur naturally, the rhesus agglutinins are always the result of external stimulus, such as the transfusion of rhesus incompatible blood or the bearing of an incompatible child. Dealing very briefly with the ABO groups, there is a theoretical possibility of danger every time a group O mother bears a child of any other group. The mother's serum naturally contains anti-A and anti-B agglutinins, and these, if present in high titre, could cross the placenta and agglutinate the foetal cells. It is suggested that the rarity of such heterospecific reaction is due to the size of the ABO agglutinins, which are too big readily to pass across the placental site. Erythroblastosis due to such a cause has been reported by Polayes and Ohlbaum (1945) and Austin and Smith (1946), whilst rare reports incriminate anti-M, anti-N and anti-P agglutinins. It has been suggested that ABO incompatibility causes abortion, whereas with rhesus incompatibility usually a full-term child is produced.

But although these rarer instances can occur, by far the commonest cause of isoimmunization is the rhesus antigen. As has been stated, the mother is stimulated to form immune bodies by a foreign antigen on the foetal red cells, and these immune bodies then pass into the foetal circulation, causing agglutination, hæmolytic and anæmia. A point needing clarification is how the rhesus antigens on the foetal cells get into the maternal circulation to stimulate agglutinins. The theory which seems to accord best with the observed facts is that foetal cells gain the maternal blood stream at parturition. As only a very small amount of red cells is necessary to stimulate antibody production, and the total area of foetal villi in the full-term placenta has been estimated as 70 square feet (Dodds, 1922), it is not difficult to imagine the amount of trauma necessary to immunize the mother. If this theory of immunization is correct it is clear that the first-born child will be out of harm's way before the mother has had time to form agglutinins. It is well known that the first child of incompatible parents is usually healthy, and when it is affected there is sometimes a history of a miscarriage before the first live birth. Stimulation of maternal antibody at the time of the miscarriage can be visualized. Again, in known cases of erythroblastosis a sharp rise in maternal antibody titre is common following parturition, suggesting that at the birth the mother has received a further dose of foetal antigen. The passage across the placenta of rhesus antibodies, as well as the more usual antibodies, is easy to understand. Wiener (1946a) has suggested that the blocking antibody has a smaller molecule than the complete agglutinin and passes the placental barrier more easily.

RHESUS INCOMPATIBILITY

For practical purposes the condition of erythroblastosis is the result of the mating of a rhesus positive father with a rhesus negative mother, producing a rhesus positive child. As has been seen, the child is usually the second or later offspring, and it has to suffer from the agglutinin stimulated by previous children and increased in titre by itself.

is any combination of the possibilities for each locus. Thus, in the Fisher classification we may have the genes CDe, cDE, CdE, CDE, Cde, cDe, cdE and cde. C, D and E were chosen presumably because they follow on the known genes of the ABO groups.

GENE NOTATIONS

Wiener	R'	R ₀	R''	R' ₀	R''	R ₀ '	R ₀ ''	Hr (r)
Abbreviation		Rh ₀		Rh ₁	Rh _y	Rh ₂	Rh _z	
Fisher	Cde	cDe	cdE	CDE	CdE	cDE	CDE	cde
Antibodies							Γ Δ H	γ δ η

Unfortunately, to designate the agglutinins to these factors, Fisher proposed Greek letters, so that anti-C was Γ, anti-D was Δ, anti-E was H, and anti-c was γ. Cappell (1944) simplified the nomenclature by suggesting that the antibodies should simply be known by their antigens, and the agglutinins are now usually known as anti-C, anti-DE, anti-c, and so on.

Reverting to Wiener's terminology (1946b), the correct superscripts of R₁ and R₂ are R₀' and R₀'', and the remainder are set down in the accompanying table with the Fisher symbols for comparison. Amongst hæmatologists many of Wiener's terms are still in use, both from habit and for ease of speech. But it should be remembered that even R₁ and R₂ are only convenient abbreviations of the full and correct superscripts, and Fisher's C-D-E classification for written communication involves much less thought. Murray (1944) suggested a system of numbers to represent the rhesus factors, but as it necessitates more facts of memory it has not found much favour.

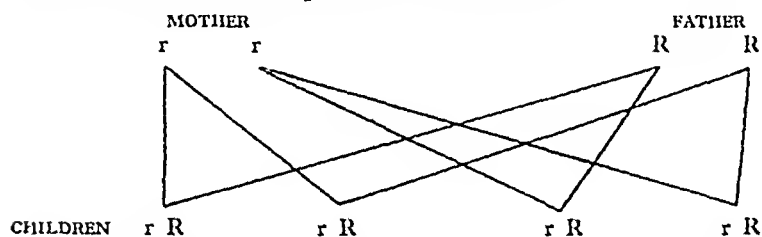
INCIDENCE OF RHESUS FACTORS

Roughly, 85 per cent. of individuals in this country are rhesus positive and 15 per cent. are negative. That is to say, one or more of the factors C, D and E is present in 85 per cent., whereas the remaining 15 per cent. have the genotype cdc cde, or rr: 93 per cent. of people have genotypes composed of combinations of the genes CDe, cDE and cde. These genotypes are CDe CDe, CDc cde, CDe cDE, cDE cDE, cDE cde and cde cde. Clearly the eight possible allelomorphs can give rise to thirty-six different genotypes. Therefore if 93 per cent. of individuals fall into the commonest six genotypes the remaining thirty genotypes must cover the remaining 7 per cent. It is obvious that some of the genotypes must be extremely rare.

MECHANISM OF AGGLUTININ PRODUCTION

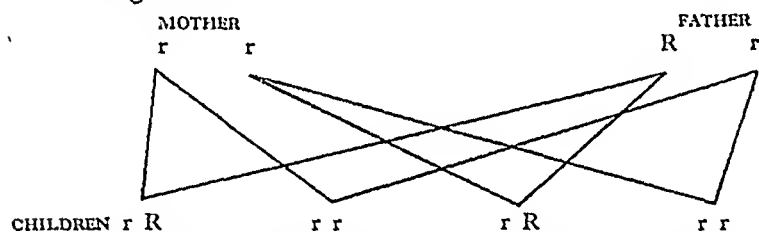
Theoretically, every time a mating produces a foetus which carries factors not present in the mother, the mother may be immunized to form antibodies which will agglutinate the foetal red cells. It is thought that the vast majority of cases of erythroblastosis are due to an incompatibility of this nature.

The following is the simplest example, with the genotypes of father, mother and the children possible from the union.

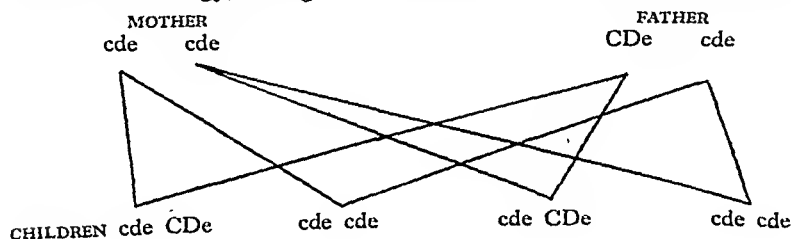


Here the genes of the mother are identical, as are those of the father, and both parents are known as homozygous. It is evident that every child that the father can produce must contain one of his R genes, or gene complexes, in its genotype, and so will be rhesus positive. As R is foreign to the mother it may stimulate the formation of anti- R agglutinins in her which will have a deleterious effect upon the foetus.

A second example is when the father is heterozygous, that is, his genes are different, one carrying one or more of the factors C , D and E and the other being cde .



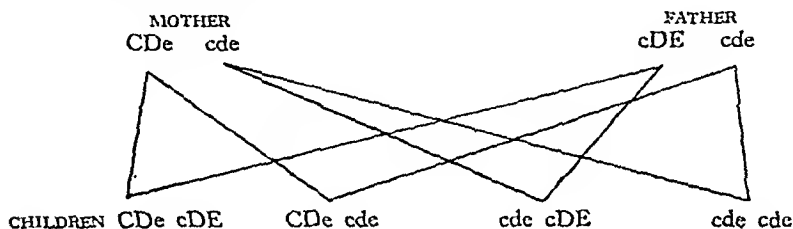
Here the possible children are two heterozygous rhesus positive and two homozygous rhesus negative. The heterozygous rhesus positive children are capable of stimulating the formation of agglutinins and being damaged by them, but the homozygous rhesus negative children are incapable of suffering from the agglutinin, no matter whereabouts in the family they come, as they possess no C , D or E factors for the antibody to agglutinate. Thus it is seen how normal unaffected children may occur in families with a strong history of erythroblastosis. It appears that R is neither dominant nor recessive to r , so that the chances in the above family of producing normal or erythroblastic infants are equal. If this family is put into the Fisher terminology, taking the Wiener Rh_1 as an example, we have:—



Here the advantage in conversation of being able to describe the first child as heterozygous R_1 instead of having to say "big C, big D, little e" heterozygote is obvious, but the lack of ambiguity in the letter system and the clarity with which the antibody can be referred to as anti-CD is much in favour of Fisher's classification.

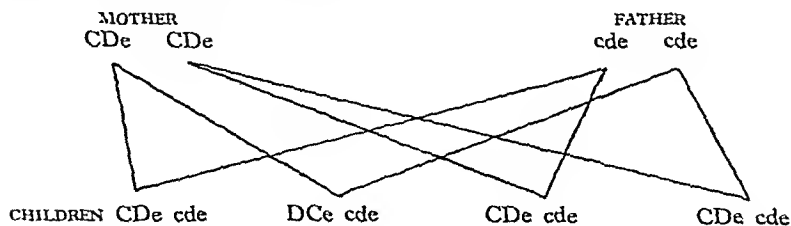
In practice, reference to a genotype as heterozygous nearly always implies that one gene is R and the other is r. Consideration of a genotype such as CDe cDE, however, shows that although heterozygous, both genes contain R factors, so that heterozygous is not necessarily indicative of an r gene.

The next example shows how, although very rarely, a rhesus positive mother may produce a child with erythroblastosis.



Here both mother and father are heterozygous and rhesus positive but their antigenic factors are dissimilar, one of the father's genes carrying E, a factor foreign to the mother. Therefore the mother may potentially be immunized to produce anti-E agglutinin which will react with the gene cDE present in two of her four possible children and cause hæmolytic disease.

Lastly, as has been stated, the small factors c, d and e are neither dominant nor recessive to the big factors C, D and E, and they may also act as antigens to stimulate agglutinins.



In this example the mother is homozygous rhesus positive and the father homozygous rhesus negative. All the children must carry cde derived from the father, and as c and d are not present in the mother they may be potential antibody stimulators. A little consideration shows that all children affected by anti-c, anti-d or anti-e must be heterozygous and rhesus positive. The mother cannot carry cde, as otherwise she would not make antibodies to any of them; therefore she must have R factors on both her genes and one of these must be transmitted to the fœtus.

The small letter agglutinins are much less common than are anti-C, anti-D and anti-E, and for a time anti-c was known as St, the first letters of the name of the patient from whom it was isolated (McCall, Race and Taylor, 1944). Clearly, many other combinations of genes and genotypes may be postulated in which a fetal antigen is present derived from the father and foreign to the mother and capable of stimulating agglutinin production in the mother, but it should be realized that even some of the more usual examples of incompatibility instanced above are very rare, and there is some doubt at the present time whether all the postulated antisera in the Fisher notation have been identified with certainty.

TESTS FOR ANTIGENS AND ANTIBODIES

Blood for rhesus testing should be taken with a dry syringe into a dry container. Cells from the clot are used for the antigens and the serum is used for antibodies. Anticoagulants should not be used, as their presence appears to interfere with the tests.

Antigens.—Tests for rhesus positiveness are straightforward. If it is remembered that about 93 per cent. of all individuals have genotypes composed of combinations of CDe, cDE and cde, then the rhesus positive ones will be detected by an anti-D serum which will react with the D present in both the R genes. There is some variability in the strength of multiple factor sera for the individual factors. For instance, an anti-CD serum usually agglutinates D cells more strongly than C cells; but in practice, anti-CD and anti-DE sera, prepared from mothers giving birth to R₁ and R₂ children respectively, should between them agglutinate all the possible gene constituents C, D and E.

For more precise genotyping, single factor sera are necessary, and ideally these should comprise all the factors C, D, E, c, d, and e. At present this ideal is unobtainable, as whereas anti-c is relatively common, anti-e is very rare indeed and there is some doubt whether anti-d has yet been identified. With the sera commonly in use in laboratories, anti-C, anti-D, anti-E and anti-c, there are some genotypes indistinguishable from one another. Thus, cDE cDE cannot be distinguished from cDE cde, as the available sera will only with certainty identify c, D and E. Consequently, on serological grounds, it is impossible to tell whether such an individual is homo- or hetero-zygous. In such a case, examination of the family pedigree may help, for if one parent were rhesus negative (cde cde) the genotype in question must clearly be cDE cde.

With good agglutinating sera, which have been absorbed for ABO agglutinins, genotyping may be carried out by the slide method, but it is preferably done in small tubes, incubating at 37° C. for $\frac{1}{2}$ –1 hour equal parts of antisera and a 2 per cent. suspension in saline of the cells to be tested.

Antibodies.—There are two types of antibody, the complete, and the "incomplete" (Race, 1944) or "blocking" (Wiener, 1944).

In testing for the complete agglutinin, suspected serum is put up in serial dilutions to 1 in 64 with saline, and to each tube is added an equal volume of a 2 per cent. suspension of R cells. After incubation for an hour the cells are examined microscopically for agglutination. If in parallel CDe, cDE and cde cells are used, all the possible components will be represented and any complete antibody should be detected. If no agglutination occurs the presence of blocking antibody must be excluded.

The presence of blocking antibody may sometimes be inferred from a zoning effect in the serial dilutions, the theory being that blocking antibody is able to inhibit agglutination in the lower dilutions but in the higher tubes has been diluted out and so is unable to exert its inhibitory effect.

Blocking antibody must be sought for by one or more of the following tests, the mechanism of some of which is not fully understood. It seems that the antibody becomes adsorbed on to the red cell envelope and prevents agglutination by the complete antibody.

(1) Blocking antibody should be able to prevent agglutination, or at least reduce the titre of an agglutinating serum, when R cells are treated with their homologous agglutinin. Since blocking antibody is practically always associated with the D factor, CDe cells are usually sufficient, although for completeness it is preferable to use bloods containing all the factors.

The cells are incubated for an hour with the serum suspected of containing the blocking antibody, washed and further incubated after the addition of the homologous agglutinin. A control test uses inactive serum instead of the suspect serum. Failure of agglutination or a reduction in titre of the test compared with the control indicates the presence of blocking antibody.

(2) *The conglutination test*: Wiener (1944, 1946a) postulated that an unspecified protein fraction in serum is necessary to give satisfactory agglutination, and he discusses the possible role of "X" protein. On the assumption that serum protein is necessary, Wiener suggested his conglutination test.

This is carried out exactly as the direct test for agglutinins, using serial dilutions of the suspect serum, but instead of saline the dilutions and cell suspension are made in human serum. AB serum is used because it contains no anti-A or anti-B, and so falsification of results by incompatible ABO groups is avoided. This method is claimed to demonstrate weak agglutinins and blocking antibody when the direct method fails.

(3) *Open slide method*: This is essentially the same in principle as the foregoing, and was described by Diamond and Abelson (1945).

Into a drop of suspected serum on a slide is put a drop of whole R blood and the slide is rocked for a few minutes at 37° C. The originators say that they obtain as good results on a slide as with the tube method. Its theoretical advantage, if Wiener's hypothesis with regard to serum protein is correct, is that by the use of whole blood any dilution of serum protein is avoided.

(4) *Rabbit anti-human globulin serum test*: This test was elaborated by Coombs, Mourant and Race (1945), and is sometimes erroneously referred to as the Race-Coombs test. These workers postulated that antibodies were adsorbed on to the red cells. An agglutinin might be present, although in too weak a concentration to cause clumping, and similarly blocking

antibody might be adsorbed on to the red cells in such a way as to prevent access to them of the agglutinins in a homologous agglutinating serum.

As antibodies are usually contained in the globulin fraction of serum, an anti-human globulin serum was prepared in rabbits. This, when absorbed for A, B and O agglutinins, was found to agglutinate foetal red cells sensitized by maternal immune bodies. The test is for antibodies, and these are made to adhere. As they are adsorbed on to the red cells, however, the red cells will also agglutinate, acting as it were as an indicator of the occurrence of antibody adherence.

It must be realized that this is not a test for rhesus antibodies but is nonspecific and is merely a demonstration of the presence of some globulin-containing substance adsorbed on to the red cells, giving so-called sensitization. In the presence of rhesus incompatibility it may be fairly assumed that the sensitizing agent is a rhesus agglutinin, but the use of the test is not confined to erythroblastosis, Boorman, Dodd and Lout (1946) having recently applied it to the differentiation of congenital and acquired acholuric jaundice. In practice the test may be made directly or indirectly.

The direct test is simply performed by adding a volume of the rabbit serum to a 2 per cent. suspension of washed cells suspected of being sensitized. The cells must be well washed, as a trace of serum protein appears to interfere with the test, and the open slide method seems to give as reliable results as the tube technique. Agglutination of the cells merely shows that they are sensitized.

The indirect test is carried out with a serum suspected of containing antibody, and demonstrates its ability to sensitize normal cells. Normal R cells are incubated with the suspect serum for an hour. They are then washed and treated with the anti-globulin serum, and agglutination indicates that the cells have adsorbed antibody from the suspect serum. This test is sometimes positive when no other method is capable of showing antibodies in a maternal serum.

A biological test is sometimes used to determine whether or not a mother in whom no antibodies are demonstrable has been previously immunized by rhesus antigens (Wiener, Silverman and Aronson, 1942).

This consists of injecting R blood of a compatible ABO group, preferably from father or child, into an r mother. Samples of serum and plasma taken immediately before and an hour after the transfusion are compared for colour, hyperbilirubinaemia in the second sample indicating incompatibility and rapid destruction of the donor's cells (see Drummond and Watkins, 1946).

This test is particularly useful when older children present some abnormality which it is desired to correlate with an earlier effect of rhesus antibody.

DIAGNOSIS

In the newborn, rhesus antibodies may cause rather divergent clinical pictures, ranging from profound jaundice to severe anaemia. The anaemia is due to haemolysis following the action of the specific agglutinin on the red cells, and this haemolysis may be the cause of some of the jaundice. But the antigens are distributed throughout the tissues (Boorman and Dodd, 1943) and part of the jaundice in erythroblastosis foetalis may be the result of liver damage by the agglutinin.

In any infant with marked pallor, excessive or prolonged jaundice or

enlarged liver and spleen the diagnosis of rhesus incompatibility must be considered. In a typical case there is an essentially normocytic anæmia, with reticulocytosis and an excess of normoblasts. The normoblasts are mostly late in type, and intermediate and earlier forms are uncommon. Severe cases may show a normoblast count of 80,000 or more per c.mm., but in the milder cases normoblasts may be infrequent or absent, and for this reason the generic designation of erythroblastosis fœtalis is unsatisfactory. The serum is usually yellow and gives an indirect van den Bergh reaction, which may be diphasic if the liver is damaged. Leucocytosis is common, and metamyelocytes and an occasional myelocyte are present in the peripheral blood. There is nothing diagnostic in bone marrow smears although hyperplasia of the red cell series is common. The urine and fæces contain an excess of urobilinogen.

The differential diagnosis of rhesus incompatibility may be extremely difficult. Physiological jaundice must be remembered as the most common type of icterus in the newborn, and jaundice due to sepsis from such a source as the umbilicus, syphilis and congenital obliteration of the bile ducts have to be considered. Sometimes familial hæmolytic icterus and hæmorrhagic disease of the newborn may obscure the issue. In many cases a history of previous jaundiced infants may indicate the diagnosis.

The final diagnosis rests with the demonstration of a correct rhesus antigenic set-up, that is, a fœtus carrying an antigen foreign to its mother, and a maternal agglutinin capable of clumping the fœtal red cells.

PROGNOSIS

Wiener (1946a) has suggested that the ordinary agglutinin is concerned with hæmolysis, and that the blocking antibody, or glutinin, is necessary to cause tissue damage. He also thinks that the glutinin is a smaller molecule than the agglutinin and passes the placental barrier more easily. If this is true the presence of blocking antibody must be of much graver import than that of agglutinin.

Of those infants who survive the initial phase of rhesus incompatibility, most authors agree that 8 to 10 per cent. develop signs later in life of residual damage to their tissues, whilst for the remaining 90 per cent. the outlook is good. Before the institution of modern methods of treatment about four of every five cases of icterus gravis died. Rhesus incompatibility has been blamed for a number of residual conditions. Lesions of the central nervous system, notably kernicterus, may give rise to many sequelæ, and spasticity, athetosis and mental deficiency are amongst the more common if the child survives. Some cases of juvenile cirrhosis and Banti's syndrome were thought by Hawksley and Lightwood (1934) to be late results, and Drummond and Watkins (1946) report families in which hepato-splenomegaly present ten years later was the sequel to apparent erythroblastosis.

Many other morbid anatomical changes have been suggested as due to intra-group incompatibility, and doubtless some will be proven. Possibly

the latest put forward by Continental workers is fibrocystic disease of the pancreas, but I have been unable to confirm the suggestion.

The question of a couple having further children after a maternal antibody has been established is one to which no hard and fast answer can be given. There is some evidence that the antibody titre rises with succeeding pregnancies, although the severity with which an infant is affected does not seem to bear much relation to the maternal titre. The children of later pregnancies, however, do appear to be the more severely affected.

With the usual incompatibility set-up—a rhesus positive child produced by a rhesus positive father and rhesus negative mother—if the father is homozygous then all his children will be rhesus positive and subject to the action of the maternal agglutinin. In such cases it is preferable to advise that no more children be conceived, owing to the overwhelming odds in favour of begetting erythroblastotic and possibly otherwise affected children.

When the father is heterozygous the answer must depend upon individual circumstances, as there is an even chance that each subsequent child will be rhesus negative and quite unaffected by any rhesus agglutinin. Conversely, each subsequent child has an equal chance of being rhesus positive and erythroblastotic, and consideration must be given to the not unfavourable prognosis and the possibility that the child may be one of the 10 per cent. who show late sequelæ.

For some unknown reason not all rhesus positive children immunize their rhesus negative mothers; Cappell (1944) records a family of fourteen unaffected children. Therefore the above advice on family limitation should be given only after the immunization of the mother, and not merely on the discovery of an incompatible antigenic set-up.

TREATMENT

The fixity of blood groups is generally accepted (Lattes, 1932), and a corollary is that with the distribution of blood groups as it is, random matings are bound to involve incompatible blood matchings and produce erythroblastotic children. The impossible ideal, of course, would be to arrange all marriages on the grounds of group, or at least rhesus, compatibility. Indeed, the reason for the breaking of some matrimonial engagements given in the daily press has been rhesus incompatibility.

In the future, work must be directed to the prevention of erythroblastosis by elimination of the maternal agglutinin before it can affect the fœtus. To this end Wiener (1946a) bled a woman who was known to have antibodies at frequent intervals throughout pregnancy, replacing the blood with harmless donor blood. The experiment seems to have been completely unsuccessful, as the baby was born with icterus and the maternal antibody titre after parturition was as high as ever; but it was a notable step in the right direction, and there is room for further work along similar lines.

The maternal antibodies exert their effect in the fœtus, but only rarely can the agglutinins be demonstrated in the fœtal serum, although Baar

(1945) says that blocking antibody is fairly frequent. It appears that at birth most of the damage has been done, so that planned experiments for exsanguinating the child and replacing the circulation with rhesus negative blood are unlikely to have more effect than to combat the established or incipient anæmia. Hampson (1929) instituted a line of treatment which consisted of the intramuscular injection of maternal or paternal whole blood or serum into the baby, and with it he obtained most promising results, notwithstanding that in the light of recent knowledge the rationale seems rather weak. With the discovery of the rhesus factors, however, blood transfusion has become the standard method of treatment.

Blood transfusion.—As the baby has anti-R agglutinins in its serum and tissue fluids, the transfusion of paternal blood, having the same R genes as the fœtus, will be subject to the same lytic action of the antibody as are the fœtal red cells. Mother's whole blood cannot be used, as although her cells are rhesus negative the serum contains more antibody. Transfusion of mother's washed cells, from which the agglutinin has been removed, is a good emergency treatment.

In practice, the transfusion of donor's rhesus negative red cells, whose serum is known to contain no antibody, gives excellent results. The hæmolytic process in the infant sometimes continues for three months, long after theoretically all the maternal antibody should have disappeared, and hæmolysis seems to occur more readily when the child is full-blooded than when it is somewhat anæmic. As, owing to its potential liver effects, further hæmolysis should be as much as possible avoided, the red cell count should not be raised much above 4,000,000 per c.mm. by transfusion. Small and frequent transfusions have been found to give better results than occasional massive ones and, although an initial large transfusion may be necessary to correct a severe degree of anæmia, the ideal line of treatment is close supervision of the case and small transfusions as required. By this means excessive hæmolysis is avoided, the red cell count can be better controlled and, by maintaining a slight degree of anæmia for the age, the bone marrow, which tends to become hypoplastic if a high count is maintained by transfusion, is stimulated to produce its own cells.

As the anæmia is due to the elimination of red cells by lysis it remains normocytic, with a colour index round about 1. In estimating how much blood to transfuse to obtain a required rise, either the red cell count or the hæmoglobin percentage may be used; but as the serum is so often jaundiced and gives false hæmoglobin readings it is preferable to base all calculations on the red cell count.

Transfusion of rhesus positive blood, with the idea of deliberately fixing all the circulating antibody as quickly as possible, is likely to increase jaundice and the chances of kernicterus, and in the present state of knowledge is not recommended. It should be remembered that blood transfusion, although undoubtedly life-saving, is merely treating one effect of the antibodies, the anæmia, and does nothing to combat the prime cause of the

erythroblastosis syndrome, i.e., the presence in the foetus of the antibodies.

Breast feeding.—It has been said that practically all the tissue fluids may contain antibodies, and this is true of the mother's milk, in which the antibody titre may often be high. On this score the suggestion has been made that when rhesus incompatibility exists the infant should be removed from the breast, on account of the dangers of possible antibody absorption. So far there is no evidence that milk antibodies have any harmful effect, and as the practical advantages so heavily outweigh the theoretical disadvantages, breast feeding should be continued.

INVESTIGATION OF ERYTHROBLASTOSIS

Single factor sera are necessary to undertake genotyping, and these are scarce and not readily available to all laboratories, but as more cases of rhesus incompatibility are investigated they are bound to yield more of the rarer sera. As the preparation of rabbit anti-human globulin serum by Proom's (1943) method is relatively easy (Race, 1946), it is expected that much more work will be done on intra-group reactions, and in suspected cases of erythroblastosis the following scheme of investigation is tentatively suggested:—

(1) The rhesus antigens of father, mother and child should be ascertained. For the set-up a good anti-D serum is all that is necessary, but if anti-CD and anti-DE are used with each sample of cells the rarer subgroups will not be missed.

(2) If the set-up is right, search should be made for a maternal antibody, and in doubtful cases this should be repeated at one, two and three weeks after the birth. It may be done by the ordinary dilution method, but as if this is negative, blocking antibody must be sought for, a short cut is to proceed immediately to the conglutination test, using AB serum for all operations. The maternal serum should be tested against CDe, cDE, cde and the baby's cells.

(3) If an antibody is demonstrated nothing further is necessary, but if the conglutination test is negative, sensitization of the baby's cells must be tested for with anti-globulin serum, and the indirect test should be performed to see if the mother's serum is capable of sensitizing normal cells.

These tests, if either is positive, will indicate the presence of a sensitizing factor which is not necessarily within the rhesus complex and which must be considered in relation to the rhesus set-up. In any incompatibility tests the ABO groups should be done to eliminate any chance of anti-A or anti-B being the etiological factor.

(4) When the mother has a high antibody titre it may be desirable to obtain blood from her for future use as diagnostic agglutinating serum. This is usually best taken about the fourteenth day after parturition, when the titre is at its highest. The nature of her antibody may be ascertained either by putting the serum up against single factor red cells (in the unlikely event of their being available) or else by determining the genotype of the infant.

(5) When further children are wanted by the parents, genotyping of the father must be carried out, particularly with regard to his homo- or hetero-zygousness, so as to obtain an idea of his chances of begetting normal children.

CONCLUSION

There are undoubtedly cases of typical clinical erythroblastosis in which no incompatibility between maternal and foetal bloods can be demonstrated and

in which the fœtal cells cannot be shown to be sensitized. But in the great majority of cases there is an incompatibility, usually within the rhesus complex, and maternal antibodies can be found capable of reacting with the infant's cells.

Our understanding of the mechanism whereby erythroblastosis and jaundice may be caused has been greatly advanced by the discovery and elaboration of the rhesus factors and genotypes, but unfortunately clinical treatment of the disease syndrome has not kept pace with the laboratory discoveries, and it yet remains to find some method of preventing maternal antibodies from acting upon the fœtus during pregnancy and producing not only congenital hæmolytic disease but its serious sequelæ.

At the present time the only form of treatment which has materially improved the immediate, if not the remote, prognosis is the transfusion of rhesus negative blood. A glance at the appended references to the literature shows how recent most of our knowledge is, and further progress in methods of treatment may confidently be expected.

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THE BANDAGE IN VARICOSE CONDITIONS

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THE supportive treatment of varices and their complications is one which has been studied throughout the ages. There is nothing new in the principle of compression treatment for gravitational ulcers or of supportive treatment for uncomplicated varicose veins. For example, in 1699, William Salmon makes some interesting remarks on the use of bandages:—

“These Medicaments be applied, according to the length of the Varix, binding it down with a part of a Reed, tied fast thereupon, with a narrow Bandage; and over all, a Hose or Buskin, made out of dog’s skin, which be put about and fastened about the Thighs by lacing it on . . .”

Again, quoting the words of Dr. Laurence Heister, in 1739:—

“Dionis here recommends a sort of leathern Stockings, which, being tightened at discretion by the Lace, are to be wore day and night. Though the same Stocking may be also conveniently made of strong brown Linen in the same form . . .”

The above extracts will show that supportive treatment was understood during the 17th and 18th centuries. Coming to the 19th century, detailed advice is found in lectures by Sir Benjamin Brodie, showing that the modern uses of adhesive bandages and diachylon bandages, together with the localized compression treatment of ulcers, were understood one hundred years ago.

“The pressure of a common roller will do a great deal of good, and formerly nothing else was recommended. But we find, now, that in cases of varicose ulcer, as in cases of indolent ulcer of the leg, you may very much assist the common roller by the addition of other means. One very good way of making pressure on a varicose ulcer is to interpose between it and the bandage a piece of sheet lead . . . It is common to employ stripes of linen spread with soap or adhesive plaster; but on the whole the diachylon plaster is to be preferred, for both soap plaster and adhesive plaster will at times irritate the skin, and bring on inflammation and pustules, while diachylon plaster scarcely ever produces this effect . . .”

It is a criticism of the modern treatment of varicose veins and their complications that, one hundred years later, I find that 90 per cent. of the cases of ulceration received only a box of ointment and a certificate as a solace for their troubles. Why is it that varicose veins are such a neglected subject? To quote once again Sir Benjamin Brodie, standing at the bedside of a sufferer from varicose ulceration:—

“This is a case in which there is no question about the patient’s life or death, and I think it very probable that many among you may pass by the bed-side of such a patient without thinking it worthy of attention. But I am not disposed to regard it in this manner. Although the patient will not probably die of this disease, yet, without great care, it may render her miserable. The disease may be very much relieved by art, and it is one of very common occurrence. . . . Such a case is one

may meet you at every turn of your practice; and your reputation in early life will depend more upon understanding a case of this kind, than upon your knowledge of one of more rare occurrence."

In other words, it is the comparatively non-lethal nature of varices, which seems to cause this neglect. The sufferers are still relegated to dark corners of the hospital, their troubles being treated by the most junior members of the staff. The results of the treatment of varices in this country are, on the whole, disappointing. Attendance at a clinic will bear witness to the lack of treatment which the majority of sufferers have received. Possibly, however, they are more fortunate than those who have been submitted to discarded methods of surgery. Only too often are seen the scars of low Trendelenburg operations or of inefficient "top ties" performed too low in the leg to allow of a proper ligation of all the important tributaries.

THE CHOICE OF BANDAGE AND METHODS OF APPLICATION

In order to produce good results in the treatment of varices and varicose ulceration, it is essential that the practitioner should give considerable care to the application of bandages, if for no other reason than that it is a treatment he can perform himself.

I propose to present some illustrations of the common supportive bandages in everyday use, with some practical comments regarding the respective applications of those which are in common use. These, however, can be used in various combinations, and the practitioner will soon find out which types of cases are suitable for the variations discussed.

The Unna or viscopaste type of bandage.—Fig. 1A, on plate facing p. 64, is a fairly typical example of varices which may prove suitable for this type of support. It will be noted that, although the limb is œdematous, the skin is "soggy" and eczematous. It is usually better in such a case to treat it by the kinder application of Unna's paste than by the use of an adhesive bandage in the early stages. Once the skin has become healthier, more strenuous methods of compression treatment may be introduced. It should be noted that a correctly applied Unna's bandage may last up to one year if properly cared for. When using the Unna dressing, 6-inch gauze rolls are well soaked in the paste and applied whilst warm. Fig. 1E shows these bandages soaking in the hot paste, and it will be realized that this method can be extremely messy. By anyone who is not actually working in a clinic, it is better replaced by the use of a viscopaste bandage. However, the gauze rolls, when applied correctly, will give a smoother and firmer support.

Fig. 1B demonstrates the method of application. It is as well to cover the entire limb with the paste by rubbing the bandage all over it. The bandage is allowed to fall into any position on the limb in which it will adjust itself without causing any creasing or ridging. As soon as the bandage tends to ruck, it should be cut at this spot and a further piece allowed to fall "where it will" on to the limb. The cutting of the bandage may be left to the patient, armed with a large pair of scissors.

Fig. 1C shows the completion of the Unna application, and the firm bandaging of the leg by means of a crêpe bandage. The paste should be present in a sufficient quantity to seep through this outer covering; a point demonstrated in fig. 1D. After a varying period of time, this outer covering becomes soiled and may be replaced by a further crêpe bandage, without disturbing the Unna dressing.

The end-result of this type of bandaging is to produce a firm elastic, emollient boot. This method of treatment has stood the test of time and, when the proper indications for its use are present, is most valuable, especially for the "hospital type" of patient.

The elastic two-way stretch bandage (fig 2).—This bandage, which is marketed by John Bell & Croyden, has now been in use for over a year and replaces the elastic adhesive bandage in the treatment of some conditions. The bandage provides a firm compression to the limb; its two-way stretch character comes into play during exercise, thus assisting a more rapid venous return. The bandage is easy to apply, can be removed at night or for the bath, and allows treatment to be given whenever the bandage is removed. When applying this bandage a loop is fitted over the foot. In the lower third of the leg the bandage is considerably overlapped so as to provide extra pressure, which is gradually released until the bandage finishes off below the knee. Compression pads may be used under the bandage in the same way as described for the adhesive type. There is no doubt that this bandage has a place in the treatment of œdema, ulceration and phlebitis. In addition, it is a useful supportive bandage in the case of severe varices. Its use is limited when dealing with the stupid patient, on whom it is better to use the adhesive type of bandage, which she is unable to remove herself. However, this I find to be the main limitation. An evil-smelling discharge oozing through an adhesive bandage—present day and night—is a horror to a sensitive patient. When she is taught to use a two-way stretch bandage intelligently, she is grateful for the healing of her ulcer in this more cleanly and comfortable manner. In my opinion, this is the ideal method of applying compression treatment to the lower limb in the better-educated patient, who, with proper instruction, becomes the "doctor" and looks after herself in much the same way as the diabetic is taught to care for herself.

The elastic one-way stretch bandage (John Bell & Croyden) is of the same type as the two-way stretch, but is made of one-way stretch material of a lighter weight and a shorter length. This bandage is useful in replacing the elastic stocking and presents the advantage over this type of support in being adjustable so far as the tension is concerned. Again, in using this bandage the maximum compressive action is required around the ankle and in the lower third of the leg. If applied correctly, the cosmetic result will compare favourably with many types of elastic stocking and it provides much better results.

These elastic bandages must be removed at night. They can be cleaned with soap and water and, with care, will last for more than a year.

THE COMPRESSION TREATMENT OF ULCERS

The series of photographs (fig. 3A to 3D) shows a method of giving *local compression treatment* to a malleolar ulcer. The internal malleolus prevents direct compression to this ulcer, unless padding is placed directly over it and built up in such a way that the elastic or adhesive bandage may give the pressure locally to the desired area.

Fig. 3A shows a large piece of adhesive felt pad, the edges of which have been suitably chamfered.

Fig. 3B demonstrates the fitting of the smaller felt pad cut roughly to the size of the ulcer.

In fig. 3 (C), the pads are both in position and ready to receive the compressive bandage demonstrated in fig. 3D. In this case, a two-way stretch bandage is being used, but the elastic adhesive bandages are more suitable for many types of patient. When using an elastic adhesive bandage in such a case, it may need removal at the end of a week, but the length of time that it can subsequently be left on will gradually increase. Once the œdematous lips of the ulcer have become flattened out and healing has begun, compression treatment may be given without the use of these localized pressure pads.

In fig. 4A, 4B and 4C, localized pressure to a large ulcer is being given by means of an adhesive felt pad which might, with advantage, be replaced by an adhesive sorbo rubber pad. In this particular case, fig. 4B shows the covering of the limb with strips of *ichthopaste*, which is found to be particularly soothing in cases of extreme dermatitis. Recently, I have had the spread of the "elastoplast" mixed with crude coal tar and, in the type of case illustrated, this particular bandage would prove of use, since it would obviate the necessity for the *ichthopaste*. The final picture, fig. 4C, shows the limb encased in a well-fitting *elastic adhesive bandage*. In such a case, the patient should be told to report again in a week's time, to take plenty of exercise and to rest always with the leg elevated. She should be advised to raise the foot of her bed, and treatment to her general health should be instituted.

Fig. 5 demonstrates the application of a *diachylon bandage* over a square of adhesive felt, used for the compression of an indolent ulcer with œdematous lips. The manner of holding the bandage should be especially noted, since this method allows the operator to gauge the right degree of tension far better than when he holds the sticky part in his hand. When using a *diachylon bandage*, especial care should be taken not to apply it too tightly. My habit is to roll it loosely round the limb and to increase the tension of each turn by a gentle pull just sufficient to crack the adhesive spread. This bandage is of particular value in cases of sensitivity to the "elastoplast" bandage, and it is not a bad plan to apply it as a routine when first seeing the patient. This allows time to do a small "patch test" on the forearm of the patient, using a piece of elastic adhesive bandage about the

size of a sixpence. This precaution will save quite a number of patients from the painful troubles of acute dermatitis.

Fig. 6 is merely an additional photograph, demonstrating further the application of a diachylon bandage. It should be noted that this bandage is being applied in the erect posture, the patient standing on a bench and supporting her weight on the shoulders of the operator.


Fig. 7 demonstrates the use of the *ceraban bandage*, in conjunction with an "elastoplast" bandage. The combination of these two bandages offers a very firm solid support, which may sometimes be left in place for many months. The use of the ceraban bandage is required particularly in those cases in which there are wide areas of skin damage. It is also of use in cases which have proved themselves to be mildly allergic to the elastic adhesive type of bandage. It should be noted, however, that in severe cases of allergy to this latter type of bandage, even this additional safeguard is not adequate. It is rare to come across cases of allergy to the ceraban bandage, although they do occur. I have recently seen a patient who developed large blisters from a small piece of ceraban placed underneath an elastic adhesive bandage, the latter causing no reaction at all. The ceraban bandage should be well warmed over the sterilizer before application. In this photograph, it will be noted that the underlying bandage is applied from below upwards, whereas the reverse elastic adhesive bandage is superimposed. As previously noted, this reversal of the second bandage has the advantage of preventing rucking. Although this method of treating the limb is more laborious than applying a single diachylon bandage, I get better results this way and give preference to this method.

Fig. 8 illustrates the application of the *semiplast bandage*, which was originally introduced as an attempt to avoid dermatitis occasioned by allergic response to the direct application of the adhesive "spread" to the limb. In cases of true allergy, I have not found it particularly useful, and prefer to adopt one of the alternatives which are mentioned elsewhere in this article. One advantage of this bandage is that it may be applied without first shaving the limb.

THE ELASTIC ADHESIVE BANDAGE

Fig. 9A to 9E demonstrate how *not to put on an elastic adhesive bandage*. The captions under each of the photographs should be adequate to explain the various points raised. A badly applied elastic adhesive bandage may do more harm than good. If firm and even pressure is not applied to the limb, ulceration may be encouraged in previously non-ulcerated areas, and my attention has recently been drawn to a case in which amputation was required in a limb the circulation of which had been damaged by faulty application of such a dressing.

Fig. 9F is included in this series in order to demonstrate the œdematous ridges on the limb occasioned by an elastic adhesive bandage. This may be obviated by previous application of strips, as described in fig. 9G, and is



3 A. The first stage of the local compression treatment of a malleolar ulcer. Note the chamfered edges of the adhesive felt pad Fig 3B The application of the second felt pad Fig 3C Felt pads in position Fig 3D, The application of a diachylon bandage Fig 4A An indurated ulcer surrounded by a large area of eczema and soggy skin which is in a re-ulcerative condition Fig 4B Adhesive felt pad in position Limb covered with strips of ichthopaste owing to the application of elastic adhesive bandage being completed It will be noted that the terminal portion of the bandage is held by means of the gauze so preventing any rucking Fig 5. The application of a diachylon bandage over a large area of adhesive felt in the case of extensive ulceration in the lower third of the leg

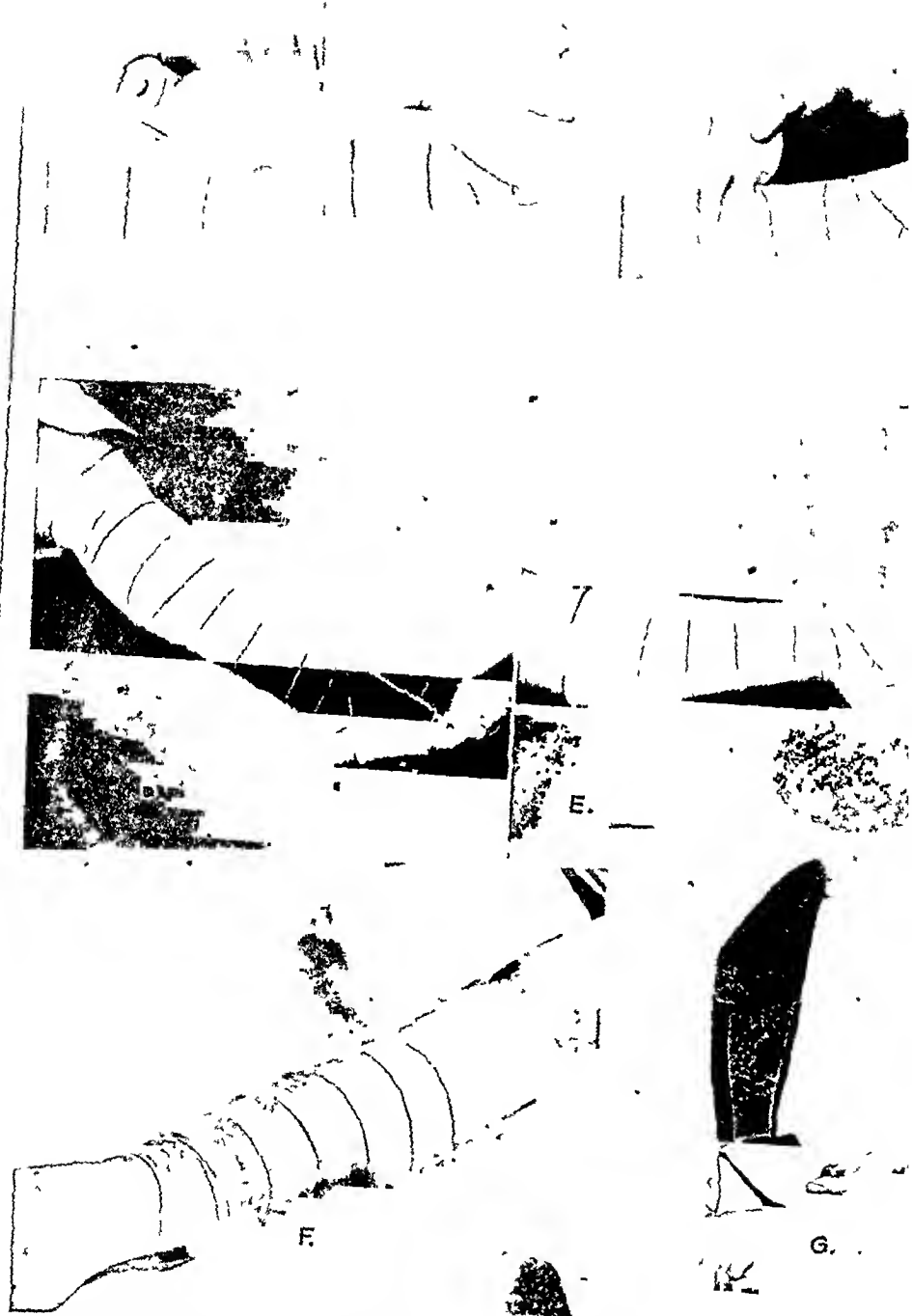


Fig 9A How not to apply an elastic adhesive bandage. Note the foot is in the equinus position that the bandage is being started too far away from the toes and that it is being held incorrectly (see text). B The bandage is being demonstrated demonstrating the ridges round the ankle which have been so occasioned. The heel has been lacking in support. C The bandage has not been sufficiently overlapped and will therefore thereby causing oedematous ridging of the limb as demonstrated in F. D The bandage has been carried too high on the limb, which is a particularly bad fault since on flexing the knee pressure will be occasioned on the deep vessels. E This badly applied bandage has been finished off too low in the limb. F Oedematous ridging occasioned by elastic adhesive bandage. G Elastic adhesive strips being put on to a limb, preparatory to the application of the spiral bandage.

also an indication for the reversal of the next bandage. In other words, if the first bandage has started from the toes, upon re-application start your bandage from just below the knee.

Fig. 9C shows the limb being covered with strips of elastic adhesive bandage before the application of the spiral bandage. This additional procedure is well worth while, since it gives a firmer support to the limb and prevents the bandage from rucking. It will be noted that these strips are not carried under the foot in the form of a stirrup, since I find that the method depicted is far more comfortable and just as satisfactory.

Fig. 10 demonstrates a well-applied elastic adhesive bandage, and also shows the method of finishing off the application. It will be noted that the operator holds the gauze strip attached to the end of the bandage. This allows the terminal portion to be applied without creasing. It will be seen that this bandage stretches from the roots of the toes to just below the flexure of the knee joint. The heel is smoothly enclosed, the bandage is firm without being tight, and no creases are present.

Fig. 11A demonstrates indolent ulceration, with an extensive area of early necrosis of the skin over a wide area. In such a case it is wise to apply a protective dressing or tulle gras (see fig. 11B) before the further application of a supportive bandage. With a cooperative patient I might treat a case of this type by means of compression, with a two-way stretch bandage over this dressing, covered with gauze and wool. With a less intelligent patient, it is necessary to apply an adhesive bandage, which, in a case like the one under discussion, will require weekly removal until the skin condition becomes healthier.

THE BANDAGE IN THE TREATMENT OF ACUTE SUPERFICIAL THROMBOPHLEBITIS

The method is illustrated in fig. 12. The days when patients suffering from this complaint were kept in bed are happily now no more. Over the past few years the ambulatory treatment of superficial thrombophlebitis has proved its value in limiting the disease and in saving the patient from wasted weeks in bed. This discarded treatment merely served to let the sufferer run a further risk of an extension of the phlebitis to the deep circulation, owing to the sluggishness of the blood-flow occasioned by this enforced rest. This photograph demonstrates a method of supporting the inflamed vein. A large soft pad, preferably of adhesive rubber, is placed over the fossa ovalis. Elastic adhesive bandaging is then applied from the roots of the toes to well over the pad, taking particular care that knee movements are not over-restricted and that the bandage does not cause undue localized pressure at any point, excepting over the pad. Moderate exercise is advocated, and either chemotherapy or penicillin is utilized, if required.

The adhesive bandage may be replaced in many cases, with advantage, by the use of a couple of two-way stretch bandages joined together. Any

tendency to slip in the groin region may be obviated by the use of a small piece of adhesive bandage. The advantage of this treatment is that the patient is still able to bath and can remove the cumbersome dressing at night. The patient can replace the pad in the correct site if this area is first marked with skin ink.

In this condition these bandage techniques are merely alternative treatments to the ideal, which is a high resection of the internal saphenous vein as soon as the inflammation is first observed. Such treatment minimizes embolism, causes a rapid subsidence of symptoms, and can be used in every case in which the top few inches of the internal saphenous vein have not yet become involved in the inflammatory process (Heyerdale, 1943).

CONCLUSION

This series of photographs, with explanatory notes, will have served its purpose if it causes the busy practitioner to realize that care is required in the application of the various types of supportive bandage. He may find by using a two-way stretch bandage in certain selected cases that he derives pleasure in watching the steady healing of a previously intractable ulcer. He will find, however, that it is easier to heal an ulcer than to keep it healed. It must be realized that once healing has taken place, however firmly, it will not remain so unless correct supportive measures are employed throughout life. Such support can frequently be discarded in those cases presenting successful results to operative treatment of the causative varices. In cases in which operation is contraindicated, as in those suffering from deep vein thrombosis or other contrary indications, supportive treatment in some form will always be necessary in order to avoid recurrence of this incapacitating and commonplace complaint.

It is as well for the practitioner to explain the gravitational causation of ulcers to his patients and to convince them that the application of medications, both internally and externally, is of little avail unless the true pathology of the condition be controlled by adequate compression. He must not be depressed by the words of that great American surgeon, Ochsner (1939), who states:—

"The overwhelming majority of patients who have varicose ulcers are indifferent, careless, dirty, indolent individuals who have neglected their varicose veins and have been too tolerant of the ulcers."

This statement is, I think, true, but in spite of this difficulty rational treatment will cause the varicose ulcer to become a rare condition.

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 I am indebted to Messrs. Smith and Nephew for their valuable help in the production of the photographs.

LIGHTING AND VISION

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THE medical practitioner feels no concern about the qualities of natural lighting as possible pathogenic factors. If his confidence in the virtue of the light of Nature does not rest upon the authority of Genesis I. iv. "And God saw the light, that it was good", it does derive from the certainty that the human eye was "born and bred" in natural light, and cannot reasonably be supposed to have survived the impact of it so long if this were at all inimical.

There is, of course, considerable variation in the intensity of natural light during the course of the day, and the range of this variation changes from month to month throughout the year. For example, on a day in January, the intensity of illumination received from the whole sky out of doors at noon is about ten times greater than it is at sunrise, and on days in June, July and August the noon intensity is about three hundred times its value at sunrise. Astronomical figures are reached if a comparison is made of the least with the greatest intensity of illumination Nature provides, and throughout this enormous range man is able to see, although, as everyone knows, ease of seeing and fineness of visual discrimination diminish as daylight fades into twilight and night. Acuteness of vision is almost as great as it can be when the intensity of illumination is about as high as that found out of doors at noon in January. It improves a little, but not very much, with the higher intensities often experienced on summer days. But the intensity of daylight inside a building is usually only a small fraction of that available out of doors.

NATURAL LIGHTING OF DWELLINGS

Close to a window in a modern house, on a reasonably open site, the daylight intensity may be about one-tenth of its value outside on the roof. Over half the area of the room, including most of the usual living space, the average daylight intensity may be no more than one-fiftieth, or even one-hundredth, of the outdoor intensity. Thus, even at noon in midsummer, the daylight illumination indoors is never good enough for vision to be quite as good as it might be. Fortunately, however, most people do not often need to reach the upper limit of visual capacity, and can see all they usually need to see, easily and comfortably, with the moderate intensities of daylight available for some hours each day in rooms where only one or two per cent. of the total light from the whole sky can be received. However, the intensity of light available in any part of a room is clearly a matter of great importance since it determines the degree of visual acuity which anyone occupying that part has at his disposal, and therefore the fineness of the detail he can see. If he wishes to read a book and the intensity of illumination only suffices for

a low acuity, then he cannot distinguish the letters at a comfortable viewing distance: he must bring the book and the eyes closer together until the image of the print on the retina is made large enough for its detail to be resolvable. But, in doing this, the accommodation and convergence of the eyes is increased, and eyestrain is likely to be experienced if the reading is prolonged.

Since the sky is the source of daylight it is clear that no light can be received directly from it at any point in a room from which no part of the sky can be seen through the windows. Daylight can only reach such a point indirectly, after being reflected from the surfaces of other buildings outside, which are exposed to sky-shine, and from those interior surfaces of the room which do receive some daylight directly. For this reason any "sky-blind" area in a room will be poorly lighted in daytime, and the illumination will generally need to be supplemented by artificial light if any exacting "visual task" has to be done in this area. It is also clear that the natural lighting of different parts of a room will be the better the greater the amount of sky visible from them. Low windows, especially in ground floor rooms, often mean that no direct light from the sky can reach a table top or a chair at the back of the room and, in heavily built-up areas, or where there are tall and dense trees near a building, direct skylight may only penetrate a few feet into a room. In dwellings, the effective height of window heads above the floor is often reduced by the use of pelmets, but the upper part of the window is the most important part to keep unobstructed if adequate daylight is to be had towards the back of a room. It is also still common for the effective width of windows to be reduced by a foot or more by the overlap of curtains at the side, thus making parts of the room unnecessarily dark. Internal window obstructions of this kind are easily avoided, but even so good conditions of natural lighting may not be available at all the usual seating positions in rooms lighted by windows in only one wall. This is the case in an overwhelming majority of domestic dwellings and, since it is due to the structural plan adopted, it must remain an inherent defect of existing houses. Most terrace and semidetached houses, as well as many that are detached, are constructed with the fireplace in the living rooms built in a wall at right angles to the only wall containing windows. On this plan it is evident that anyone sitting by the fire on the side remote from the windows will almost face the source of light. To read in this position is very trying, because the reading matter faces away from the light and must receive less illumination than the eyes of the reader, who therefore suffers from glare. If the present method of heating dwellings is retained, fireplaces should be built in the dividing wall between front and back living rooms so that no-one occupying a customary seating place in winter need be badly placed in relation to the window. Unfortunately, to do this, whilst at the same time allowing suitable positioning of doors, would probably involve an addition of some three feet to the frontage of the typical small dwelling, and there seems little prospect of securing this in these times. It is much more likely

that the problem will in future be solved by discarding the conventional method of house warming in favour of one which imposes no structural limitations on the disposition of the occupants.

ARTIFICIAL LIGHTING

If the natural lighting of many building interiors is not all that it might be, it is not the quality of the light that is at fault. With artificial lighting, however, it seems that the very nature of the light is sometimes thought to be "bad for the eyes". Presumably this is what is meant by the statement seen in a lay journal dealing with health, that "all artificial light is more or less unnatural and is bound to put a certain amount of strain on the eye". In this, the conclusion obviously does not follow logically upon the premise, and although the spectral composition of light from artificial sources in common use is not identical with that of daylight (which, incidentally, is not invariable), there is no evidence that it is harmful to the eyes and, on theoretical grounds, no reason for suspecting that it might be. But artificial lighting is frequently bad for other reasons, usually because there is not enough of it, or the light is not suitably directed or diffused, or because the light sources themselves are not suitably placed or screened from the eyes, and they therefore give rise to glare. These and other faults can be avoided and, if they are, no ocular discomfort or dis-ease is likely to be occasioned by artificial lighting. It seems necessary to stress this statement because even medical practitioners have been known to blame "artificial light"—unqualified by an appropriate adjective such as "bad" "faulty" or "inadequate"—for a patient's eyestrain or other ocular complaint.

A case in point is that of a female clerk employed in a blacked-out factory office during the war. She consulted her doctor for eyestrain and was told it was due to "working with artificial light". This she reported to her employers who, realizing that the office was in fact inadequately lighted, took the necessary steps to raise the level of illumination. The result was disconcerting. Confronted with the now adequately lighted office, the woman became hysterical, saying, "The doctor said my trouble was due to artificial light. Now you've given me more of it and I shall get worse"!

Adequacy of illumination.—It can be said with assurance that, of legitimate complaints about artificial lighting, a high proportion is due to the fact that insufficient illumination is available. Levels of illumination on the objects we wish to see, in houses and other buildings, are generally much higher with natural than with artificial lighting, hence it is not surprising that many people find they cannot see so well in the latter as in the former. In the average domestic sitting room of to-day artificial lighting provides a general illumination which is no better than the room would have on a dull day if it received only about one-half per cent. of the external daylight. This is undesirably low for some of the most usual domestic pursuits, e.g. reading and sewing, and for homework by the children. Whether or not bad lighting results in any permanent deterioration of children's sight, it is

certainly undesirable that they should have to sit with bowed head and bent back, peering at what they have to see. Not only does this usually defeat its object, by shadowing the "work", but the posture restricts the ventilation of the lungs, and sustained work at the near point of convergence encourages any latent tendency to squint. In the kitchen—the housewife's "workshop"—artificial lighting is usually no better, and is worse at some important points, e.g. sink, pantry and cooker. It is, of course, a fairly frequent practice to supplement the general illumination in living rooms by means of movable table lamps or floor standards and, if these are of good design, their use can be recommended. Insufficient illumination should always be suspected in cases of "eyestrain" experienced with artificial light, and it should be understood that no benefit is likely to be obtained by any increase of illumination of less than fifty per cent., or even one hundred per cent., as, for example, by the substitution of 100 watt for 60 watt lamps.

Glare.—Discomfort and strain under artificial lighting are also caused by unduly high contrasts of brightness within the normal field of view. These are present when bright sources of light, such as the incandescent filaments of electric lamps, are not screened by suitable fittings. Unfortunately, failure to screen them is all too frequent both in dwellings and other buildings, such as schools, offices, factories, hospitals—and surgeries! If people having no affection of the eyes involving photophobia complain of too much light in an artificially lighted room, it is extremely likely that the sources of light are glaring, and very unlikely that the general brightness of the room is excessive, since this is almost certain to be lower than it is in daylight, when conditions are acceptable. Glare can, of course, be experienced not only by direct vision of very bright light sources but also of shiny surfaces and mirrors which glitter or image the light sources. The avoidance of glare, with its discomfort and disturbance of the sensitivity of the eye, thus depends upon the brightness of parts of lighting units which may be visible directly, or by reflection, being not greatly in excess of the average brightness of the illuminated structural surfaces and room contents comprising the occupant's visual field. This condition can be satisfied by various means.

METHODS OF ARTIFICIAL LIGHTING

None of the readily practicable systems of artificial lighting can be said to be ideal for all interiors. The most familiar and widely used method is the *semi-direct*, in which the type of shade or fitting used with the lamps does not completely enclose them, and is of translucent material. Fittings of this type include the familiar, and much to be condemned, shallow conical reflector of opal glass, as well as many popular domestic fittings, made in a variety of materials, colours, and shapes, which are more satisfactory in some respects. In this method of lighting, anything from 10 to 40 per cent. of the light from the lamps may be directed upwards, for reflection by

the ceiling and upper walls, whilst from sixty to ninety per cent. is distributed downwards. This method is economical, but gives rather sharp shadows and pronounced highlights. It is essential that the fittings used be deep enough to screen the lamps themselves completely from the eyes of the room occupants at every normal angle of regard, but even when this is so, glare due to reflection from shiny surfaces in the room which can "see" the lamps may be experienced. Another method, which is widely used, e.g., in offices, and is gaining ground in dwellings, makes use of diffusing fittings which completely enclose the lamps. By this means a room is more uniformly illuminated than by the semi-direct method, shadows are softer, the brightness of the fittings can be suitably proportioned to the general brightness of the room, and the risk of glare due to reflection is reduced. However, it should be understood that if the fittings are to be efficient they must not be of such a colour and material as to absorb much light, and that if this condition is fulfilled, their brightness can only be limited to a comfortable value if their size is suitably proportioned to the candle power of the lamps used. A fitting should not be used with a more powerful lamp than it was designed to take.

Another method, *the semi-indirect*, is extensively used for the lighting of living rooms in dwellings. With this, the lamp is screened from ordinary view by suspending under it a translucent bowl, or similar fabricated fitting. A higher proportion of the light from the lamp is directed upwards than downwards, and with a clean and light-coloured ceiling, comfortable conditions of lighting can be obtained. The method has two drawbacks: for a given illumination of a room more, or more powerful, light sources are required than with the semi-direct method, and the bowls are excellent dust collectors and must therefore be cleaned frequently.

With *totally indirect lighting* the lamps are concealed by opaque pendant or wall fittings, or by structural features, such as a cornice, and the room is illuminated entirely by light reflected from the ceiling and upper part of the walls. Very good diffusion is obtained, shadows are soft, and glare is avoided. It is a relatively expensive but excellent method of lighting many interiors.

FLUORESCENT LIGHTING

In any of the methods of lighting described it is possible to use tubular fluorescent lamps if desired. These lamps became available in the early months of the war, and were subsequently installed extensively in blacked-out war factories, and in other vitally important places where daylight could not be had. Lamps of this kind are efficient sources of light which closely resembles daylight in its colour-rendering characteristics, although similar lamps are now made to give light of "warmer" colour. The surface brightness of the lamps is fairly low, so that, even when seen bare, they are far less glaring than ordinary electric lamps and, since the light they emit is

diffused, they do not give dense shadows. It appears that a large majority of persons who have experienced lighting derived from these lamps like it, and appreciate its similarity to natural daylight. Occasionally, however, complaints are made about it, and it has been suggested that it may have harmful effects upon the eyes. One ground for fearing such effects is that fluorescent lamps emit some ultra-violet radiation. They do, but it is not of shorter wave length than is found in the solar spectrum, nor is its intensity so great as it is in direct sunlight, or even in diffuse daylight, so that if the latter does not harm healthy eyes neither will the radiation from the fluorescent lamps. The operation of the fluorescent lamp depends upon the production, *inside* the lamp, of ultra-violet radiation of shorter wave length than that received from the sun, but this radiation is absorbed by the layer of fluorescent powders with which the lamp is lined, and is thus converted to visible radiation. Even without its lining of fluorescent materials, the glass of which the lamp is made is an effective barrier against emission of harmful ultra-violet radiation.

The only other ground of objection to fluorescent lighting which need be discussed is the fluctuating or pulsating light output of the lamps. This does not mean that any fluctuation of light can be directly observed by looking either at the lamps (provided their extremities are concealed by properly designed fittings) or at stationary objects illuminated by them. Fluorescent lamps are almost always operated by alternating current of fifty cycles per second, which is the kind of electricity supply now generally available. This means that the lamps are actually lighted and extinguished one hundred times every second; but this frequency is high enough to produce a continuous sensation of light and to prevent any visible flicker. Ordinary electric lamps behave in a similar way, except that their filaments do not cool rapidly enough for the complete extinction of light during the very brief periods when they receive no current. It is only when rapid movement of the eyes, or of some object under regard, occurs that the rapid pulsations of light from fluorescent lamps may make the movement of objects seem jerky or jumpy. At certain critical speeds it may also make a rotating object, such as a spoked wheel, appear to be at rest, or to be moving much more slowly than it really is, either in a clockwise or anti-clockwise direction. This (stroboscopic) effect may, of course, be disconcerting, and even dangerous in certain special circumstances, but it is not usually troublesome, and if more than one lamp is used the effect can be minimized by operating them in a particular manner. Persons of "nervous temperament" may well be worried by occasional stroboscopic effects which do not disturb other people, but in general it can be said that fluorescent lighting is not merely harmless but most satisfactory and pleasing.

HAY FEVER PROPHYLAXIS IN THE ROYAL AIR FORCE

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RECOGNIZING that hay fever can be a disabling condition resulting in transient but serious loss of efficiency, the Royal Air Force offers prophylactic treatment to all ranks. This is brought to the notice of personnel during the December and January of each year in a concise statement which also points out that "prevention is better than cure".

The *prophylactic material* made available in the R.A.F. is "pollaccine" (Parke Davis & Co.), in individual outfits containing graded concentrations of the pollen extract up to 50,000 units per c.cm. (one unit is the amount of extract that can be made from one-millionth of a gramme of Timothy grass pollen—*Phloeum pratense*). Phials containing 100,000 units per c.cm. are also supplied if specifically requested.

A skin-test (cutaneous reaction) outfit is also available, consisting of capillary tubes of the pollen extract (20,000 units per c.cm.) and normal saline for control.

TESTING FOR ALLERGY

Careful case histories are taken from all applicants. A skin test is then performed (a prick through a drop of pollaccine, 20,000 units per c.cm., compared with normal saline as a control) and the positive reactors noted. A control wheal (dermographia) must be subtracted from the toxin response in making the assessment. Negatives and doubtfuls are repeated before finally declaring an applicant negative. Prophylaxis is then offered to the positives and the outline of treatment indicated. Continuity and persistence as the keynotes of success are stressed. The possibility of side-reactions is mentioned and their symptoms explained. For all those accepting prophylaxis, individual outfits are obtained, for, after treatment is begun, the patient takes his outfit with him whether on leave, detachment or posting. Full records of dosage, reactions and results are maintained.

TREATMENT

Details of treatment are left to the individual medical officer and notes for his guidance are issued by the manufacturers with each "pollaccine outfit". I have found that with the close supervision of patients possible in the R.A.F. considerable modifications to the suggested method can be made, to the benefit of both patient, who requires fewer injections, and the doctor who has to administer them.

As the weight of pollen inhaled per unit time during the hay fever season is unknown (variables of wind, weather, geographical situation and the like

render such a determination useless) the dosage is quite arbitrary. As a result of my experience I consider that a minimum essential is that sufficient to render the patient negative to a 20,000 unit dermal test. This has required, in every patient, a much higher dosage than the maker's literature would suggest, but the success attained would indicate that this is well worth while. A phial of 200,000 units per c.cm. would facilitate these higher doses.

The method used is as follows:—Injections are administered twice a week (Mondays and Thursdays seem to interfere least with work and furlough), beginning on March 1 or late in February with 50 units subcutaneously. The dose is increased each time by 100 per cent. until the patient develops a reaction. This is of immense value as it demonstrates to the patient his own "reaction pattern", and by prompt injection of 3 minims of adrenaline shows him how readily it is controlled. Thereafter increments of 85 per cent. are made until the earliest symptom of a reaction again calls for a reduction. No reduction of dosage is made during intercurrent malaise, as no lessened tolerance has been noticed, provided there is no fever. When the patient goes on leave, he is given his outfit and a written scheme of dosage to cover the period of his furlough; these injections are given either by his own doctor or the nearest Service medical officer.

Skin tests are carried out after a dose of 50,000 units has been reached and thereafter, at 50,000 unit intervals until the cutaneous reaction becomes negative. For the last three or four injections, daily administration may be necessary to complete the course before (about) May 24, or, if desensitization is more rapid, as judged from the alteration in the skin reactions, the last few injections may be given weekly.












RESULTS

Side-reactions have been very few and very mild. Each individual appears to have his own "reaction pattern". A typical reaction begins five to twenty minutes after the injection, with pruritus of the inner orbital canthi succeeded by itching of the anterior nares and genitalia, conjunctival injection, sneezing, rhinorrhœa and lachrymation. If left untreated these symptoms may subside, but usually a short, irritative cough develops and urticaria, first of the face then the "belt" area, axillæ and genitalia, later becomes generalized. The expiratory dyspnœa of a typical asthmatic attack may supervene but neither this nor œdema of the glottis have been encountered in this series. A throat spray containing adrenaline is kept constantly to hand for the treatment of this latter emergency. Individual reactions vary chiefly in the order of onset of symptoms. They were always aborted by the administration of 3 minims of adrenaline subcutaneously. A feature occasionally noted was a delayed urticaria coming on seven to eight hours after injection, itching intensely, relieved by calamine lotion and subsiding spontaneously in one to two hours; this did not respond to adrenaline. A curious and not uncommon complaint was of mild anorexia, depression, irritability and of feeling "out of sorts" in the middle of the

course, starting at about 10,000 units and finishing at about 50,000 units dosage levels. This vague malaise came on about eight hours after the injection and lasted for one to two days. It was volunteered independently by several patients that this was very similar to the mental and physical depression experienced during the hay fever season.

A typical case was Corporal R.L. Aged thirty-two, his hay fever had started at the age of twenty-four years. He had suffered annually and his symptoms were severe and disabling. His attacks began between June 7 to 10 and lasted until the end of July. He did not experience any attack in the "second hay fever season". Pollaccine injections to a dosage of 50,000 units at the ages of twenty-seven and twenty-nine years had been entirely unsuccessful. He suffers from recurrent urticaria; dermographia can be demonstrated. His mother and daughter suffer from hay fever; an uncle is an asthmatic. His cutaneous reactions are shown in figure 1. Treatment was begun on March 1 and finished on May 24. In all, 25 injections were administered and mild reactions resulted after four. He suffered from the mild depression described above between April 3 and 19. He passed the season symptom-free, except for a slight occasional itching of the inner orbital canthi.

FIG. 1

Date	Dose Units	Control wheal	Toxin response (actual size)
24/1	nil		
17/4	50,000		
7/5	120,000		
14/5	158,000		
17/5	207,000		
24/5	260,000		
27/5	260,000 (repeat test)		

Of 34 applicants over the past four years, 28 reacted positively to the pollaccine skin test and gave typical histories of seasonal allergic rhinorrhœa. The results of their treatment are set out in table 1.

TABLE 1

Positive reactors	F.H. of allergy	Posted, defaulted or untraced	Complete records available for	Passed season symptom-free	Average dosage
28	23	9	19	18	208,000 units (extremes 125,000 and 280,000)

The one failure reported that his hay fever had been much milder than usual. Unfortunately, owing to Service exigencies, further investigation of this case has not been possible.

I have to thank Dr. D. A. Williams, Miss L. I. Scott, and Messrs. Parke Davis & Co. for the information they so readily tendered.

PAIN AND ITS PROBLEMS

I.—THE PHYSIOLOGY OF PAIN

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SENSE organs are stimulated and afferent impulses set up when some significant change occurs in the environment. The nervous system then takes what action is necessary to readjust the body to the new conditions so that the sensory stimuli shall cease. In this way, by securing their own reflex extinction, the afferent messages keep the organism working efficiently and ready to face any fresh change that may occur. The change may be either in the external or internal environment. When the reaction to it is an elaborate one involving the higher levels of the nervous system the principle may be hard to trace, but it is obvious enough in the simpler adjustments carried out by the brain stem and spinal cord. For instance, a rise of blood pressure stretching the carotid sinus stimulates receptors whose afferent discharge lowers the pressure and relaxes the sinus again; the expansion of the lungs sends impulses up the vagus to cut short the movement of inspiration; stimulation of the labyrinth by an abnormal posture of the head causes the movements needed to bring the head back to its normal posture; and itching promotes the scratch reflex to relieve it.

It is not difficult to think of exceptions to the rule, but clearly pain, the signal of danger or damage to the body, leads to reactions designed to minimize it, whether they be the simple protective reflexes of the spinal cord or the elaborate planning of the cerebrum involving such operations as the foundation of hospitals and the prosecution of medical research.

Physiological research may be thought of as one of the long-range reactions to pain, but no physiologist can be content with what has been achieved by it. Something has been learnt of the conducting apparatus, of the structure of the nerve fibres and endings which give rise to pain and of the pathways in the spinal cord, but the initial and final stages are still uncertain. It is not known precisely how various kinds of pain arise, nor is it known how they affect the highest levels of the nervous system. Recent advances have been mainly in knowledge of the peripheral mechanism. This is where we must begin, although the main outcome has been to deprive us of some attractive simplifications.

PAIN ENDINGS

So far as the sensory endings are concerned, all recent evidence has confirmed the view that pain is produced by the stimulation of the fine terminal

This is the first of a series of articles on The Problems of Pain. In the February issue Dr. Gordon Holmes will write on "The Clinical Aspects of Pain".

branches of nerve fibres which end freely without any capsule. The encapsulated endings are most probably the specialized receptors for stimuli which are not painful. There are various regions devoid of them but supplied with free endings, like the cornea, and these are sensitive to pain but not to touch. Again, skin areas which have been denervated and to which only pain sensitivity has returned are found to contain only the free endings. They are by far the most common form of afferent fibre termination on arteries, in fascia and in all deep-seated regions from which pain can arise. As Sherrington pointed out many years ago, the free ending seems the obvious form of receptor for the varied stimuli the one common feature of which is the injury they are likely to cause.

The free endings which form the plexus under the skin are derived from the smaller myelinated fibres and probably from the non-myelinated afferent fibres which Ranson found in the dorsal roots. By *intra vitam* staining with methylene blue Woollard and Weddell have shown that it is the smaller nerve fibres in the rabbit's ear which give pain reactions and that the larger fibres do not. This confirms the evidence which came from Gasser and Erlanger's analysis of the electric response of mixed nerves. Their method, based on the differences in conduction rate in fibres of different size, has shown that the largest afferent fibres, those of 10 to 20 μ diameter, conduct most rapidly and are concerned with tactile and muscular sensation but not with pain. They are excited by weak electric shocks, incapable of causing pain when the nerve is stimulated *in situ* in a conscious patient, and when they are put out of action, by pressure or asphyxia, the appreciation of pain is not lost. Conversely, at a certain stage in the action of cocaine the smaller fibres cease to conduct, leaving the larger still in action, and at this stage pain is lost but touch remains.

But the exclusion of the larger afferent fibres leaves many more of smaller diameter to which it is more difficult to assign specific functions. They can be divided into myelinated fibres ranging from 6 μ in diameter down to 2 or 3 μ , and non-myelinated fibres of 1 μ diameter, or less. The latter conduct very slowly, at 1 metre a second or less, the former at rates varying from 10 to 40 metres a second. Sensations of contact and of temperature are produced by the myelinated group and there is little doubt that fibres of both groups can give rise to pain.

Little is known about the distribution of the non-myelinated fibres, but two groups which differ so much in structure and speed of reaction might be expected to produce two different types of pain. It might be expected, for instance, that sharp, well-localized or "bright" pain might be due mainly to the rapid fibres and dull aching to the slow. There may, perhaps, be an element of truth in the suggestion, but the only evidence available is directly opposed to it. The evidence relates only to superficial pain and to that produced by a very brief stimulus. It depends upon the argument that since the myelinated fibres conduct so much more rapidly than the non-myelinated a momentary stimulus might be expected to give an initial sensation

of pain due to the former, followed by a delayed sensation due to the latter. Now it is a well known fact that a "double pain" with two distinct peaks of sensation can be produced by a prick on the back of the finger or most easily by pressing the finger just below the nail bed against a hot surface, e.g., an electric light bulb. Lewis and Pochin (1937) have timed the arrival of the two waves of pain using stimuli applied to various parts of the body. They find that the interval between the two waves corresponds to the difference in the rate of conduction of the two kinds of fibre and that the first or the second pain can be eliminated by procedures which would block conduction in the rapid fibres or in the slow. It is therefore difficult to escape the conclusion that the two waves of pain are due to the two kinds of afferent fibre. Yet the difference in the quality of sensation is negligible. Localization, duration and disagreeableness are, so far as can be judged, the same for the first as for the second pain whether the stimulus is a pin prick or a contact with a hot surface. This result has at least the merit of ruling out many speculations about the origin of pains of different quality.

One other important point which has been established is that any stimulus to the surface of the body will be likely to excite the endings of a large number of different fibres, however sharply the stimulus may be localized. A "touch spot", a hair or a "pain spot" is not innervated by one fibre but by several, and these fibres supply other spots as well. By its repeated branching one nerve fibre may supply an area as much as 1 cm. in diameter, the terminal branches forming an interlacing network with those of other fibres the distribution of which overlaps the same area. Thus, however restricted the stimulus, the sensory message which reaches the central nervous system will be a composite affair and the quality and local sign of the resulting sensation will depend upon a summation of effects from many fibres. For instance, it is probable that some of the smaller fibres may give rise to sensations of itching, tickle or continuous pain according to the number in action and the frequency of the discharge in each of them.

PAIN STIMULI

No doubt the same kind of nerve fibres and endings take part in the production of pain from the deeper parts of the body, but unfortunately the pains which are of most interest to medical science are far less accessible to investigation than are pains from the skin. Even for the skin endings we cannot be certain of the precise mechanism of stimulation. It is generally held that the essential change involved in the excitation of a nerve fibre is a sudden increase in the permeability of the surface membrane. This change sweeps down the fibre, the membrane restoring itself almost immediately to the resting impermeable state. Thus the change at any point, the nervous impulse, is a very brief affair and the activity can only be maintained as a series of impulses following at short intervals. In the larger nerve fibres injury to the surface leads to a discharge of impulses which fails after a few seconds owing to some kind of adaptation, but in many of the sense organs

the discharge will continue indefinitely, so long as they are subjected to mechanical strain. It follows that at the nerve ending region adaptation may be very slight, and it is probable that in the pain fibre the surface is easily broken and slowly restored over a considerable distance before its actual termination.

The problem is therefore to decide what kind of change is likely to affect the surface membrane of the pain ending in such a way as to make it permeable. Both mechanical and chemical disturbances might bring this about and the stimuli which arouse pain are likely to produce both. Thus a pin-prick on normal skin may act by liberating a stimulating substance (e.g. Lewis's "H substance") from injured cells, but it could scarcely avoid causing direct mechanical effects on the nerve endings by stretching or bending them. Again, in an inflamed area, although the H substance may act as a chemical stimulant to the nerve endings, it might also act indirectly by dilating capillaries and causing turgor and mechanical disturbance. Changes of H ion concentration and of the balance of Na and Ca can certainly alter the stability of the membranes and may lead to a discharge of impulses, and for some kinds of pain there is the further possibility that the electric currents accompanying the activity of efferent fibres may stimulate some of the afferent fibres in contact with them. Normally, a nerve fibre can be active without influencing its neighbour, but the insulation is lost if the surface is damaged, and it has been suggested that the pain of causalgia may be caused in this way, by the direct interaction of sympathetic with pain fibres at the site of the injury (Doupe, Cullen and Chance, 1944).

DEEP PAIN

So far as deep pains are concerned the adequate stimulus is often the excessive contraction of smooth muscle; in arterial spasm, for instance, or in intestinal colic. What kind of mechanical disturbance this would produce in the afferent endings is not very clear, but it should be enough to cause a temporary breakdown of the surface membrane in some part of the terminal sections of the fibre. Excessive stretching of a duct during the passage of a stone would certainly do so. In inflammatory conditions, capillary distension and other associated phenomena may lead to the mechanical stimulation of pain endings, and it is presumably the chief factor in any pain which is associated with movement. But clearly, chemical factors may assist by making the surface membrane less stable, and even when pain is the immediate response to mechanical disturbance the intervention of a chemical factor cannot be ruled out. If a motor nerve impulse excites a muscle fibre by the sudden production of acetylcholine there is no reason why pain fibres should not respond to equally brief chemical changes in their vicinity. Chemical changes are obviously predominant in the pain arising from ischaemic muscle (e.g., after coronary thrombosis) and Gernandt and Zotterman (1946) have shown recently that changes in the CO_2 tension of the blood modify both the discharge of impulses from injured nerve fibres

and the tingling which develops when the circulation is restored to an ischaemic limb.

For the present, then, the prudent course is to keep to Sherrington's conception of the pain ending as one in which the surface may be disturbed by a number of agents. A discharge of impulses should start from any point where the breakdown occurs, and the evidence suggests that in many regions (e.g., around the arteries) a single fibre is accessible to stimulation over a considerable length, either because the surface membrane is generally less stable than in the larger fibres or because the pain fibre gives off terminal branches at many levels.

REFERRED PAIN

The wide ramifications of the individual nerve fibres help to explain how pains can arise from so many deep regions which have a relatively scanty afferent nerve supply. It helps also to explain the poor localization of deep pain or its reference to the surface of the body. To account for this peripheral reference we must suppose (a) that there is a convergence of pain pathways from the surface and the interior so that some of the ascending fibres in the cord are accessible to both, and (b) that in default of special localizing signs a message which reaches the point of convergence will always be judged to have started from the surface. Both assumptions are reasonable. As regards (a), it is probable that the convergence takes place at the spinal level, since Head and Mackenzie showed that deep pains are referred to the skin of the corresponding spinal segment. It is known that both superficial and deep pain fibres activate spinal neurones which transmit the message by the opposite antero-lateral column, and some of these neurones may well be shared by both. As regards (b), it is clear that any message from the skin will be relatively well localized: the skin has a rich afferent supply, and it can be seen and touched, so that the brain has built up a detailed reference map of the body surface. The deep structures are not represented in this map. Therefore if a pain message from them shares some of the pathways from the skin, its place in the map will be referred to the skin. The bias in favour of surface reference has been demonstrated very clearly by Kellgren's (1939) studies of pain induced by hypertonic saline injected at various depths from the surface.

Some of the phenomena of peripheral reference cannot be explained so simply. The tenderness of the skin and the occasional disappearance of the pain when the skin is anaesthetized involve something more than a common pathway. They suggest something like Head's irritable focus in the spinal cord. The modern equivalent of this would be a collection of spinal neurones sharing the synaptic terminals of fibres from the skin and from the interior and needing impulses from both sources to raise them to the point of discharge. Since a light touch to the skin is enough to excite many of the smaller fibres, the impulses in these fibres might sum with impulses from the viscera to produce pain. This is by no means the whole story. There are

certainly various reflex effects as well which may accompany referred pain. They are both somatic and sympathetic and a complete account of them would probably cover also the reflex effects on the deep structures of counter-irritants applied to the surface.

CENTRAL EFFECTS

The spinal cord.—The function of the pain endings and nerve fibres is to cause reactions which lessen the pain and thereby protect the body from damage. The initial response to a surface stimulus is a withdrawal of the limb; the reaction to an injury is an inhibition of the movements which will increase the pain, and so on. The immediate reactions to an urgent signal are managed by the spinal cord and the higher centres may be unable to control them, for we are dealing with a mechanism which must act automatically and at once, whatever the cerebral hemispheres may have planned for the general direction of behaviour. But clearly, the reactions to pain signals cannot proceed entirely at the spinal level. They must reach the cerebrum and enter into consciousness if the organism is to face the danger effectively, and they must retain their urgency and power of overriding less important reactions. We are dealing, however, with a mechanism for use in emergencies when widespread and violent action may be of more value than exact control and when more and more of the body may have to take part in avoiding the danger and bringing the signals to an end.

Sherrington's analysis of the spinal reflexes has shown some of these characteristic features of the response to pain. The flexion and withdrawal of the limb is a reflex which lacks the precise timing and localization of the specialized reflexes concerned with posture and locomotion; the spinal activity spreads more and more widely when the afferent discharge is increased and it may continue after the stimulus has ceased. Modern electro-physiological studies have been concerned with the detailed structure of the reflex arcs, the number of neurones in the chain and the complexity of their dendritic connexions. Pain reactions involve a "three neurone arc", i.e., with at least one neurone confined to the grey matter besides the afferent and efferent neurones. In the diffuse conducting network made by these internuncial neurones the activity can spread widely and can be raised to high intensity owing to the opportunities for summation which will occur. Thus an intense pain stimulus may come to dominate the whole executive apparatus of the cord. It does not appear that there is any qualitative difference between the neurones concerned in the response to pain and to other kinds of stimulation, although the time course of the excitation may be longer in some of them.

The brain.—When we come to the higher levels of the central nervous system the effects of pain are again diffuse and generalized rather than confined to precise channels. Head's conception of the optic thalamus as the organ for the perception of pain may need some revision; certainly pain

is not felt without reference to a particular part of the body, and the spatial image of the body is elaborated in the cortex. Yet there are no regions of the cerebral cortex especially concerned with the reception of pain, as there are with tactile, auditory or visual signals, and no points on it which give rise to pain when they are stimulated electrically. In fact, the effect of a pain message on the cerebrum seems to be mainly on the central regions which control the general level of cortical activity. In a narcotized animal a painful stimulus to a nerve will lead to an increase in the electrical waves throughout the cortex, and pain messages are clearly more potent than any others in rousing the brain from sleep, and in capturing the attention.

In so far as the general level of consciousness and the direction of attention depend upon the thalamus and hypothalamus it can be argued that it is in these regions that the affective quality of pain is generated. Tactile, visual and auditory signals may acquire a strong emotional appeal as a result of previous experience and of associations elaborated in the cerebral cortex, but pain needs no learning to increase its potency. This must be due to a direct effect on the basal ganglia. The cortex no doubt contributes to the perception of pain as a mental event, but the pain signals themselves play little part in the elaboration of cortical or mental patterns.

The affective quality of pain needs no excuse if we regard the pain message as a danger signal. For the brain and the mind, as well as for the spinal cord, it must be something which will dominate all other signals and will force the organism to take whatever action is needed to stop it. Therefore when it comes into consciousness it must be as urgent and undesirable as possible. The reflex apparatus of the spinal cord can render the first aid: it can withdraw the limb, immobilize the injured region and adjust the blood flow. The cerebrum can go a further ahead to avoid renewed danger. But, acting alone, the individual cannot always take effective action to end his sensation of pain any more than he can always succeed in ending sensations of hunger and thirst. We must still suffer pains which seem to have no purpose but to remind us of our frailty. By their collective action, however, human brains and minds are capable of devising new methods to aid their bodies. The spinal cord may react to pain by the flexion reflex: the cerebrum can do so by calling in the doctor to suppress the danger signal and to assume responsibility for the danger. In fact the human intelligence, developing medicine and surgery, has already taken effective aid to prevent unnecessary pain, and there is no reason to think that its resources are at an end.

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REVISION CORNER

This section is devoted to short articles in which experts summarize modern treatment and clinical procedures, particularly for the benefit of general practitioners who have returned from the Forces.

GASTRO-ENTERITIS IN CHILDREN

GASTRO-ENTERITIS is the commonest and most lethal infection in infants, and remains a serious menace throughout childhood. Therapeutic advances, such as that recently introduced by Darrow of Yale (U.S.A.), are therefore welcome.

CLINICAL FEATURES

Mild form.—In the great majority of cases anorexia, irritability, and sometimes fever followed by diarrhoea are present; vomiting is common.

Severe form.—Acute onset. There is complete anorexia, irritability followed by prostration, and usually vomiting and fever. Diarrhoea sets in within twenty-four hours, and signs of dehydration soon appear. Prostration increases, the pulse rate rises and the urine output falls. Acidosis occurs, unless vomiting is severe, and frequently causes hyperpnoea. Melæna is uncommon except in dysentery.

The acute toxic type is characterized by an abrupt onset with high fever and extreme prostration. Vomiting is often severe; convulsions may occur. Diarrhoea may not appear for many hours. Signs of dehydration may be slight, but metabolic disturbance is acute.

ETIOLOGY

The condition is usually due to infection, but in the majority of cases no pathogenic bacteria are demonstrable. Recent work suggests that many obscure cases may be caused by unidentified viruses. Epidemic diarrhoea of the newborn is apparently a virus infection, and is the usual cause of gastro-enteritis epidemics in maternity hospital nurseries. Bacillary dysentery is the most common identifiable type of gastro-enteritis in Britain, particularly Sonne dysentery, which is endemic and often becomes epidemic. It is usually mild, but may be fatal. Flexner dysentery is not uncommon and is usually acute. Typhoid is generally a milder disease in children and 50 per cent. have no diarrhoea. Salmonella infections, which include *S. paratyphoid* A and B, should be remembered. Paratyphoid resembles typhoid fever; the others, like *S. typhimurium* (Gaertner's bacillus), cause acute gastro-enteritis (food poisoning). Food poisoning gastro-enteritis may also be produced by the toxins of organisms contaminating food; *Staphylococcus aureus* is the commonest cause. Simultaneous cases and an acute short illness are the features. Parenteral infection as a cause has probably been overrated; the complicating gastro-enteritis is often a secondary infection easily contracted in an ill, susceptible patient.

DIAGNOSIS

Examine the stools bacteriologically at the outset. A rectal swab may be more convenient. Culture within a very few hours, as some pathogenic organisms have very poor viability. Failure to demonstrate is common—repeat.

Differential diagnosis.—Non-infective diarrhoea has many causes, such as excess of food, especially in young infants; unsuitable food, such as high milk fat in infants or dietary indiscretions in older children; plant or chemical poisons. Starvation diarrhoea in infants often deceives, because stools are loose, green, and contain mucus, and diet is often reduced further instead of being increased. Allergy to food factors is a common cause of diarrhoea and is usually difficult to prove. Acidosis with diarrhoea and vomiting is common; there is a history of recurrent attacks. Chronic digestive disorders, such as coeliac disease and pancreatic fibrosis, have characteristic features (stools, etc.). Emotional disturbances may cause vomiting and diarrhoea.

TREATMENT

Prophylactic.—Cleanliness and sterilization of feeding utensils are essential. Infective gastro-enteritis is often contracted in day nurseries and nursery schools: it is extremely contagious and rigid precautions are necessary to prevent cross-infection. The same precautions are needed to safeguard the victims from contracting other infections in their susceptible state. In institutions, immediate precautionary isolation of all who develop diarrhœa is necessary.

Therapeutic.—This depends upon severity and age. The fundamental principles are:—(1) Stop all food except glucose. Glucose supplies calories, spares tissue proteins and requires no digestion. (2) Restoration of water balance. (3) Restoration of electrolyte balance in the extracellular and intracellular fluids. (4) Drug therapy. (5) Gradual resumption of oral feeding when appetite returns.

Mild cases.—Stop all food except glucose solution, 5 to 10 per cent., plus an equal volume of physiological saline; give frequently *ad lib*. Flavour with orange juice after infancy. When appetite returns, usually by the second day, introduce boiled, half-strength skimmed milk plus dextrimaltose, 5 to 10 per cent. (any diluted low fat milk with added sugar, e.g. Nestlé's 1 to water 6), giving half the normal volume to infants and maintaining fluid intake ($2\frac{1}{2}$ to 3 ounces per pound body weight per day) with 5 per cent. glucose solution. The rate at which milk is strengthened to undiluted skimmed milk, followed by increasing proportions of whole milk, depends upon the rate of progress (appetite). Go slowly and keep the patient rather hungry. In older infants and young children the diet is gradually built up along the usual lines.

Sulphonamides—slowly absorbed forms like succinyl-sulphathiazole, should be given unless the diarrhœa seems definitely non-infective. Although often unnecessary in mild cases, give it, as the disease might become severe. Give 3 to 5 grains (0.2 to 0.32 gm.) per pound body weight per day, divided into four-hourly doses. There is no dramatic effect, but the drug appears helpful in most cases. Kaolin in large doses of 2 to 3 gm. per pound body weight per day may be given in preference to bismuth or chalk when the diarrhœa shows signs of abating, but it is unimportant, as diarrhœa is a symptom.

Hypodermoclysis of physiological saline or, alternatively, Darrow's solution (see below) with or without an equal volume of 5 per cent. glucose solution, giving 10 to 20 c.cm. per pound body weight once or twice a day, often produces great improvement if signs of dehydration develop.

Severe cases.—Immediate hospitalization and the provision of expert medical and nursing care are highly desirable in this grave metabolic emergency, particularly in infants, in whom water depletion and electrolyte deficit progress more rapidly. Bold measures must be instituted immediately to restore water and electrolyte equilibrium in the extracellular and intracellular fluids, otherwise many preventable deaths will occur. If the patient is "shocked" reduce handling to the minimum and maintain a warm room but avoid local heat, which may dilate skin capillaries and delay rise of blood pressure. Oral feeding is stopped and intravenous therapy begun at once. After a short period of physiological saline administration, whole blood or plasma (5 to 12 c.cm. per pound body weight), along with an equal volume of physiological saline is given over a one- to two-hour period. This should be given in all severe cases whether obviously shocked or not, as shock might develop insidiously. In less severe cases physiological saline and 5 per cent. glucose solution may be given instead. This initial therapy improves the circulation and thereby restores renal function, which must be assured before more specific electrolyte therapy is begun. While the intravenous apparatus is being assembled, blood samples are taken for estimation of the serum bicarbonate (CO_2 combining power) and chloride as a guide to electrolyte therapy, and this may be repeated later for further guidance.

The intravenous shock treatment is immediately followed by the administration of Darrow's solution, which has the following formula:—

KCl	..	..	..	..	..	..	2 gm.
NaCl	..	..	..	..	..	..	3 gm.
Molar sodium lactate	..	..	..	..	..	..	40 c.cm.
Water	..	..	..	..	..	..	710 c.cm.

Sodium lactate is included to counteract the acidosis.

The recent important work of Darrow (*J. Pediat.*, 1946, 28, 515, 541) has led to more enlightened parenteral fluid and electrolyte therapy, with more rapid recovery and a great fall in mortality. The electrolyte solution introduced by him, or a somewhat similar solution, is likely soon to replace the established solutions, such as Hartmann's, for routine treatment. He has demonstrated that potassium can safely be given in parenteral solutions in much greater concentrations than was formerly considered safe, and that now not only can the extracellular deficit of sodium and chloride which occurs in dehydration quickly be restored, but also the serious intracellular deficit of potassium. (In diarrhoea Na, Cl, a little K, and water pass from the extracellular fluid in excessive amounts to be lost in the stools, and there is a serious loss of intracellular K to the extracellular fluid to compensate for the loss of Na. Most of the Na in the body is extracellular and most of the K intracellular.)

During the first twenty-four hours Darrow recommends 40 to 70 c.cm. per pound body weight of his solution by slow drip, given during the first eight- to twelve-hour period, with enough 5 per cent. glucose solution given during the twenty-four hour period to bring the total water intake up to 75 to 130 c.cm. per pound body weight. After the first day, smaller amounts of Darrow's solution (10 to 25 c.cm. per pound body weight) are given daily for as long as the stools remain watery, with enough 5 per cent. glucose solution to raise the daily fluid intake to 75 to 90 c.cm. per pound body weight. When it is necessary to continue intravenous therapy for several days the addition of amino-acid and vitamin solutions to improve nutrition seems desirable. These substances should be added to the intravenous glucose solution, not to the alkali solution (Darrow's), in which they are unstable. Amino-acids are given in the form of an enzymatic hydrolysate of casein and pancreatic tissue, and to avoid reactions in the patient its concentration in the glucose solution should not exceed 3.5 per cent. The thiamin fraction of vitamin B (5 mgm. per day) is the most important vitamin to supply, but the riboflavin (0.5 mgm. per day) and nicotinic acid (20 mgm. per day) fractions, and vitamin C (ascorbic acid, 50 mgm. per day) are also usually given. Some clinicians also add water-soluble preparations of vitamins A and D to the intravenous glucose solution.

Milk feeding is begun when the stools are no longer watery and the dehydration has been overcome (see mild cases). Begin with 5 to 10 calories per pound body weight per day, diluting the milk with sufficient water to give 75 c.cm. of fluid per pound per day. If this amount of fluid is not taken, supplement with subcutaneous or intravenous physiological saline and/or 5 per cent. glucose solution. The calorie intake is increased gradually over a period of one to two weeks to normal. Darrow recommends the addition of 1 to 2 gm. of KCl to the day's oral fluid for as long as the calorie intake remains below 30 per pound body weight per day.

Parenteral potassium must be used with caution, because heart block ensues if the potassium blood level rises to double the normal figure. Hence the necessity for ensuring satisfactory renal function before beginning to use it and also a slow rate of administration. If collapse with heart block occurs, discontinue administration immediately and give calcium gluconate (15 c.cm. of 10 per cent. solution) by intravenous injection and 15 per cent. glucose solution (20 c.cm. per pound body weight) by rapid drip.

Careful supervision of the diet is necessary for many weeks after recovery, as chronic intestinal indigestion often dates from an attack of infective gastro-enteritis.

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VINCENT'S GINGIVITIS, TRENCH MOUTH, ULCERO-MEMBRANOUS GINGIVITIS

THIS disease, leading to an acute ulcerative condition of the oral mucous membrane or throat, is characterized by necrosis of the superficial tissues, which appears as a dirty white or yellowish membrane and is easily detached, leaving a raw bleeding surface. It is frequently confined to the gum margins. The etiology is, at present, unknown.

Once the disease is established, two common inhabitants of the mouth, a fusiform bacillus and a spirochæte, first described by Vincent and Plaut, take on a more luxurious form of growth, and in a smear made from the infected area they will be found to be the predominant organisms. Attempts, however, to produce the disease by transferring these organisms to a healthy mouth have so far failed. It would appear that these organisms must be considered as secondary invaders, the favourable conditions for their growth being produced by some predisposing factor. Many quite different initial factors may be involved in the primary lowering of tissue resistance and so pave the way for invasion and further damage by Vincent's organisms and, ultimately, produce the same clinical picture.

CAUSAL FACTORS

In some cases, the disease is highly contagious and quickly spreads through a closed community; perhaps in such cases the initial factor is a virus. On the other hand, deficiency diseases, especially those in which vitamins A, B, or C are absent over a period, may be the prime factor. Such cases are not contagious and often make a remarkable recovery if saturated with the missing vitamin. Local factors are equally important for, although the disease may occur in healthy mouths receiving every care, it is most frequently found in mouths that have been neglected, when the initial lesion usually occurs in some part of the mouth with a lowered resistance, such as the traumatized pad of gum over an erupting lower third molar or merely in an area of chronic stagnation.

SIGNS AND SYMPTOMS

The disease is sudden in onset and rapidly progresses to the ulcerative condition. Usually the lesion starts at a spot on the gingiva that has previously been the site of chronic irritation. The area becomes swollen and red and bleeds at the slightest touch; it quickly becomes covered by a greyish-white exudate, and within twenty-four to forty-eight hours the crest of the gingiva becomes necrosed, having the appearance of a dirty white or yellowish-grey membrane. There is no suppuration. The necrotic tissue can easily be wiped away, leaving a raw bleeding surface. The condition spreads rapidly round the mouth and within twenty-four hours the whole of the gingiva may be affected. It tends to remain limited to the gingiva, however, and extensions to the cheeks and the throat occur only in the more severe cases. There is an offensive and characteristic odour from the mouth. There is a mild febrile condition, the temperature rising to 100° to 101° F. (37.8 to 38.3° C.), but in severe cases it may rise to 103° to 104° F. (39.4° to 40° C.). The submaxillary lymph glands are enlarged and painful but never suppurate. Pain is severe, and the patient is unable to brush his teeth or masticate his food. Even the pressure of the cheeks on the inflamed gums when speaking is painful and the patient speaks with the least possible movement of the jaws.

DIAGNOSIS

A diagnosis is made from the sudden onset, the necrosis of the gingival margin, and the appearance of the necrosed tissue as a yellowish-white membrane, which easily wipes off, leaving a raw bleeding surface, and the severe pain.

A bacteriological examination in the case of Vincent's gingivitis will show a marked increase in the numbers of two common mouth organisms, the fusiform

bacillus and the spirochæte of Vincent. The diagnosis is not, of course, made upon the presence of these organisms, but upon the very marked increase in the numbers seen in a smear made from an affected area.

TREATMENT

Local.—The fundamental basis of all treatment is irrigation and the aeration or oxygenation of the area affected. The first objective is to free the mouth of necrotic tissue and stagnating food. This can be effected by the use of an atomizer spray, which should be used frequently during the acute stage, at least three times a day. H_2O_2 , when it comes in contact with necrotic tissue, loosens it and facilitates its removal. The oxidizing property of H_2O_2 also has a definite action on the *Bacillus fusiformis* and the spirochæte of Vincent, for they are anærobæ, and oxidizing agents inhibit the growth; and these organisms, although they may be considered as secondary invaders, do seem to have a very definite influence upon the course of the disease.

Following the initial cleansing of the area with the spray, it is advisable to swab the area with some antiseptic that will be absorbed by any remaining necrotic tissue, and so still further inhibit any bacterial growth. The aniline dyes are useful, such as:—

Crystal violet	..	..	0.5 gm.
Brilliant green	..	..	0.5 gm.
Alcohol	..	..	50 c.cm.
Water	..	..	50 c.cm.

To apply the drug, after irrigating with H_2O_2 , carefully dry the area involved with cotton-wool rolls, and then press a pledget of cotton-wool, soaked in the dye, against the tooth. The expressed dye will then flow around the tooth and, possessing a low surface tension, enter any pockets or crevices.

Penicillin has proved very effective in arresting the acute condition. It should be used in the form of lozenges containing 200 to 500 units: one should be allowed to dissolve slowly in the mouth, every hour. Even in the absence of any other treatment, penicillin will effect a marked improvement within two or three days, but it cannot be too strongly stressed that although the treatment described will allay the acute condition, cases will relapse or pass into a chronic stage unless they also receive active dental treatment, such as scaling and the elimination of any stagnation areas.

General.—If the temperature is raised above 100° F. (37.8° C.), the patient should rest in bed.

The diet, which in the initial stage must be liquid, should include fruit juices and, later, liberal quantities of green vegetables. It can be supplemented with vitamin concentrates, such as redoxon (two tablets, three times a day) for vitamin C, and radiostoleum (one capsule, three times a day) for vitamins A and D.

The bowels should be kept open, and a mild saline purge can be prescribed with advantage.

If necessary, the pain can be controlled by 10 grains (0.65 gm.) of aspirin.

The patient should be warned that the disease is contagious, and that he should use separate dishes, glasses, and eating utensils. Cooks, or persons who handle food, should be taken off duty.

PROFESSOR F. C. WILKINSON, M.Sc., M.D., D.D.Sc.

THE DIAGNOSIS AND TREATMENT OF GLAUCOMA

GLAUCOMA is a term used to denote a state of increased intra-ocular pressure. The condition occurs in two forms; (1) the so-called primary glaucoma, the cause of which is unknown, and (2) secondary glaucoma, occurring as a complication of ocular disease or injury. Primary glaucoma may be acute or chronic.

ACUTE PRIMARY GLAUCOMA

Acute primary glaucoma is a disease of middle and old age, affecting women more frequently than men, and the small, hypermetropic eye rather than the normal or the myopic eye. The acute attack may occur without warning in an apparently normal eye, but in many cases a series of prodromal attacks occurs over a period of weeks or months. These prodromal symptoms consist in transient attacks of vague ocular pain, mistiness of vision and the appearance of coloured rings around lights. Following these symptoms, which the patient usually disregards, the acute attack supervenes, frequently precipitated by overwork or worry. The symptoms are pain, impairment of vision and a varying degree of constitutional disturbance associated with nausea and vomiting. The pain, which may be extremely severe, affects the eye and radiates over the distribution of the trigeminal nerve. Examination shows œdema of the lids and watering of the eye, which is intensely red and the conjunctiva may be chemotic. The cornea is steamy, the result of epithelial œdema, and anæsthetic; the anterior chamber is shallow, although not in every case; the pupil is oval, dilated and inactive. In most cases the examination of the fundus is difficult or impossible. The eye, on digital pressure, is found to be hard, sometimes stony hard.

Differential diagnosis.—The acute constitutional disturbance may be of such severity that the ocular condition is overlooked.

In *acute conjunctivitis* the patient complains of a discharge from the eye associated with a feeling of gritty discomfort rather than of actual pain. Vision is not affected. Constitutional disturbance is not a feature except in severe purulent cases. The lids may be swollen; the discharge is usually mucopurulent in type, crusting on the lid margins and causing them to stick together. The eye may be very red and the conjunctiva chemotic, but the injection is conjunctival in type rather than circum-corneal (ciliary); in severe cases the differentiation may be difficult. The cornea is bright and clear but may be affected in extremely acute cases; the corneal sensitivity is normal. The anterior chamber is of normal depth, the pupil circular and active, the lustre and pattern of the iris unimpaired. The eye may be slightly tender to the touch but the tension will be found to be normal.

The onset of *acute iritis* may be very sudden and associated with severe pain of neuralgic character affecting the eye and the distribution of the trigeminal nerve. Some constitutional disturbance may be present. On examination, the lids may be swollen, the eye is watery. The eye may be intensely red but the injection is ciliary in distribution. Chemosis may be present. There is some haziness of the cornea due to œdema but corneal sensitivity is normal; the anterior chamber is of normal depth and the aqueous is turbid. The pupil is contracted and inactive; the normal lustre and pattern of the iris are impaired. The eye is tender to the touch but the tension is normal. *The essential diagnostic features of acute primary glaucoma are the dilated, oval, inactive pupil, and the raised intra-ocular tension.*

Treatment.—This is a matter of urgency on account of the serious effects of the greatly increased intra-ocular pressure on vision. The first aim of treatment is to constrict the dilated pupil so as to open the angle of the anterior chamber and permit the re-establishment of the circulation of the intra-ocular fluids. To this end miotics are administered, eserine being more effective than pilocarpine. Aminoglucosan (a substance related to histamine), although a powerful miotic, is contra-indicated in acute primary glaucoma on account of the severe inflammatory reaction it produces. Adrenaline lowers the intra-ocular pressure by its action on the blood vessels of the eye although the pupil dilates. Its use in acute primary glaucoma, however, is highly dangerous and is absolutely contraindicated. Intensive eserine therapy is instituted immediately the diagnosis is made. This consists in the instillation of a solution of 1 per cent. eserine in oil into the conjunctival sac at intervals of 15 minutes, associated with constant hot-bathing of the eye. As a prophylactic

measure a drop of eserine is instilled into the other eye. Leeches are applied to the outer canthus; morphine is given, and a saline purgative administered. A fall in intra-ocular pressure may also be effected by the intravenous injection of a hypertonic solution of sodium chloride, glucose or sucrose. The maximal effect is seen in about six hours and is followed by a reactionary rise in the tissue fluid pressure. On account of this slow reaction and subsequent rise in pressure, together with the possibility that the reduction in intra-ocular pressure will be inadequate, this form of treatment should be used rather as a pre-operative measure. If the eye responds to treatment, as shown by the clearing of the cornea, the contraction of the pupil and the lowering of the tension, intensive treatment is stopped, and the eye is kept under the influence of eserine until all signs of inflammation have subsided. A drainage operation is then performed in order to prevent further attacks.

If treatment is ineffective in six hours an operation will be necessary in order to relieve the pressure. The operation of choice is the broad iridectomy, the essential feature of which is the removal of a large sector of the iris complete with its root.

CHRONIC PRIMARY GLAUCOMA

Chronic primary glaucoma is a disease usually of middle and old age occurring in small, hypermetropic eyes associated with small corneæ. The onset and course of the disease are insidious and, owing to the fact that central vision may not be affected until very late, the progressive loss of the visual field may pass unnoticed by the patient for a long time. The patient may be conscious of some ocular discomfort, difficulty with reading and the appearance of coloured rings around lights. The diagnosis depends upon the presence of shallow anterior chambers, slightly dilated and sluggish pupils, cupping and pallor of the optic discs. The intra-ocular tension is raised. Examination of the visual fields shows peripheral contraction, more pronounced on the nasal side, a nasal step and later wide sector defects. The earliest changes occur in the region of the blind spot with the so-called barring of the blind spot.

Treatment.—In spite of treatment the disease tends to be slowly progressive but much can be done to retard the progress of the condition. Miotics are employed to reduce the intra-ocular tension, eserine and pilocarpine being the most widely used. A careful watch is kept on the tension of the eye and on the visual fields; if the eye fails to respond to the action of miotics some form of drainage operation must be undertaken.

SECONDARY GLAUCOMA

The diagnosis of this condition depends upon the recognition of a state of raised intra-ocular tension in an eye already the seat of some disease or injury. The treatment is of the cause, associated with active surgical measures to reduce the tension where necessary.

HUMPHREY NEAME, F.R.C.S.

NOTES AND QUERIES

Subscribers are invited to make use of the service provided in this section. Answers from experts will be obtained and dispatched as soon as possible to the senders of the queries. Publication of selected and suitable queries and replies is arranged according to available space.

Persistent Post-Herpetic Neuralgia

QUERY.—I have been consulted by a female patient, aged sixty, who is suffering from intractable post-herpetic neuralgia. She developed the attack of shingles two years ago and has not obtained any relief from the usual analgesics. What line of treatment would you advocate? Would the parenteral administration of vitamin B help her? The site of the herpes was in the left lumbo-sacral region.

REPLY.—In some cases of post-herpetic neuralgia, relief is afforded by protection of the skin from cold, and from mechanical assaults; e.g. by the growing of a beard by the victim (male) for pain of trigeminal distribution. In the present case it may be worth trying the effect of covering the painful area with cotton-wool or adhesive plaster. X-ray therapy may be considered, but is unlikely to succeed at this late stage. On no account must massage or other ordinary form of

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"truth" and "beauty" which denote concepts so general in their nature that no sensible person would attempt their definition in summary form. The most difficult words, however, from the standpoint of definition, are those which present a pleasing aspect of concreteness, but which on closer inspection are found to be, in Whitehead's phrase, "generalizations of a high order of complexity". Such words include "disease", "symptoms", "organism"—and also "cachexia".

✓ The O.E.D. defines "cachexy" as "a depraved condition of the body, in which nutrition is everywhere defective"; and etymologically the word should mean a bad bodily habitus. Although the word is in its origins a synonym for "wasting", custom has limited its

application to the particular form of wasting which is associated with chronic and often incurable disease, such as cancer. The multiple etiology of cachexia vitiates any attempt to determine its "true nature"; for it adds little to the argument to say that defective intake, digestion, absorption or utilization of food must be concerned, and that anæmia and infection are often present in cachectic states. The mechanism of death in cachectic states may well be a peripheral circulatory failure. For a full discussion of this hypothesis, the reader is referred to chapter XXIII on "The Mechanics of Death" in Virgil H. Moon's book "Shock and Related Capillary Phenomena" (New York, 1938).

D. A. K. BLACK, M.D., M.R.C.P.

PRACTICAL NOTES

✓ *Ascorbic Acid in the Treatment of Methæmoglobinæmia*

As a result of experience with two patients, M. Carnrick and his colleagues (*Archives of Internal Medicine*, September 1946, 78, 296) recommend ascorbic acid for the treatment of methæmoglobinæmia. In one patient the condition was due to the ingestion of sodium nitrite, whilst in the other a diagnosis of idiopathic methæmoglobinæmia, or enterogenous cyanosis, was made. The first patient was considered to be so ill that she was given 500 mgm. of ascorbic acid intravenously. Within four hours, when a further 200 mgm. were given intravenously, the cyanosis had almost disappeared. During the remainder of the day a further 300 mgm. were given intravenously in two doses. The other patient was given 500 mgm. daily by mouth in divided doses for three days. There was a noticeable improvement in her condition within twenty-four hours. Subsequently she was given 1000 mgm. daily for several days. This action of ascorbic acid is due to its reducing properties, and there is evidence to show that it reduces methæmoglobin *in vitro*. Ascorbic acid is considered preferable to methylene blue, the current form of treatment, because of the risk that methylene blue may further increase the concentration of methæmoglobin in the blood. Ascorbic acid need only be given by the intravenous route in conditions of emergency; oral administration should usually be satisfactory.

The Treatment of the Male Climacteric

In a report of the study of the symptoms of 273 male patients, 230 of whom were in the climacteric, A. A. Werner (*Journal of the American Medical Association*, September 28, 1946, 132,

188) describes the method of treatment adopted in 181 cases. The average age of the patients treated was 50.5 years. 177 patients were treated by intramuscular injections of testosterone propionate, 25 mgm. being given every other day for the first month or two, and then, on improvement of the symptoms, twice weekly for one month, followed by weekly injections to keep the symptoms under control. The climacteric syndrome, which comprises nervous and circulatory disturbances, decrease of potency, easy fatigability, irritability and depression, varies in its duration according to the individual; it may last for six months to five or six years, or even longer in some cases; the only criterion is a strict check-up on the return of endocrine stability. Of the 177 patients to whom intramuscular injections of testosterone propionate were given, 173 received benefit and four did not report any improvement. Four patients were treated orally, receiving six to eight 10 mgm. tablets daily; in three the symptoms were much improved and in one there was slight improvement. An oily solution of testosterone propionate was employed, and it is pointed out that as such solutions have a tendency to leak from the injection site, a piece of adhesive plaster, 1 inch square, should be applied immediately, the patient being instructed to remove it the following morning.

A New Product for the Treatment of Scabies

THE use of "eurax", a synthetic product, the active principle of which is croton-N-ethyl-o-toluidine, is reported by W. Burckhardt and R. Rymarowicz (*Schweizerische Medizinische Wochenschrift*, November 23, 1946, 77, 1213), who have treated a series of 326 cases

physiotherapy be used, for these usually aggravate the pain. Adequate rest is essential. Vitamin B given parenterally cannot be expected to assist, unless the patient is for some reason deficient therein. Among analgesics permissible, trilene vapour cautiously inhaled under supervision of a nurse or relative deserves mention. On general grounds it is perhaps worth while to try vasodilators. They certainly help in some "idiopathic" neuralgias. Lastly, some sort of surgical procedure may have to be considered. Division of the affected posterior root, proximal to the ganglion will afford relief, provided there is no lesion of the grey matter of the cord. In the event of involvement of the posterior horn of the spinal grey matter, section of the spinothalamic tract may need serious discussion. That tract should be severed which lies on the side contralateral to the reference of the pain. The neural level at which the tract is cut should be situated some seven segments above the segment.

H. A. DUNLOP, M.D., F.R.C.P.

Circumcision in Infancy

QUERY.—It is generally advised that the prepuce of a male infant should be mobilized until full retraction is possible, and that if this seems likely to be impossible, circumcision should be done. The majority of male infants are recommended some treatment of this kind, and I wonder if it is really necessary? Is it known in what proportion of children who receive no treatment of this type balanitis occurs, and in what circumstances?

REPLY.—The chief indication for circumcision in infancy is extreme narrowing of the preputial orifice, so that the examiner cannot see the external urinary meatus on attempted retraction of the foreskin. Sometimes, although the meatus may be visible on retraction, a very long prepuce tends to become inflamed by the continual irritation of an acid urine. When such cannot be made to clear by the use of an alkaline mixture, it is better to perform circumcision, as also when there are repeated attacks of balanitis without such apparent cause. There are no other really strong indications for circumcision in infancy, although the inclinations of many parents and doctors are in favour of its performance as a hygienic measure. Gentle retraction in the early years is probably beneficial, but this should not be forced. If it eventually appears that full retraction cannot be achieved, or only achieved with difficulty, circumcision should be performed. Quite a number of adults complain of the irksomeness of a tight foreskin and bemoan that they were not circumcised in early life. With advancing years the tightness

becomes progressively worse. Some adults encountered in whom the foreskin has never been retracted, and in these, circumcision reveals a collection of filthy smegma. Carcinoma of the glans penis has only rarely been encountered when the foreskin was completely retractile.

CHARLES DONALD, CH.M., F.R.C.

Catheterization in Cephalic Presentations

QUERY.—On several occasions I have found impossible to introduce either a rubber or metal catheter to empty the bladder in maternal cases with cephalic or face presentations where due to arrest at a low level, forceps delivery was indicated. In such cases I have always aspirated the bladder suprapubically and then successfully carried out a forceps delivery without a harm to the patient. A female metal catheter which is lightly gripped when being introduced between the presenting part and the posterior surface of the os pubis, even if forcibly introduced to its full length, has failed to reach the bladder and has only left me with a fear that might have damaged the urethra. In view of this failure and the possibility of damaging the urethra and soft tissues I have resorted to aspiration. Can you enlighten me on the correct procedure in such cases?

REPLY.—I have almost always found it possible to displace the head slightly upwards with the first two fingers of the right hand in the vagina. It is then possible to guide a rubber 7 or Jacques catheter into the bladder with the help of these two fingers in the vagina. On the rare occasions when this manoeuvre fails, I do a low forceps operation without emptying the bladder. There can be no risk of injuring the bladder by this procedure, as is the case with a high forceps delivery. I then catheterize after delivering the child, and prior to the expulsion of the placenta.

J. B. BLAILEY, M.B., F.R.C.S., F.R.C.O.

Cachexia

QUERY.—"Cachexia" is a term much bandied about and, it seems, little understood. I have been unable to obtain a satisfactory account of the condition, which is variously described "a toxic phenomenon"; "an exhaustion state" and so on. I should be extremely grateful if you can enlighten me on the true nature of the condition; also its causation, and the actual cause of death from such states.

REPLY.—In the traffic of speech we use countless different sizes. The simplest words are used to denote concrete, often individual, objects whilst at the other extreme we have words like

the megaloblastic bone marrow to the normoblastic state but did not restore the blood picture to normal. The subsequent administration of proteolysed liver by mouth produced a normal blood picture in one case, failed in a second, and the third was receiving proteolysed liver at the time of publication. On the basis of the small series recorded, a daily dose of 5 to 20 mgm. folic acid daily is suggested (not less than 20 mgm. daily in pernicious anæmia), but as individual cases of pernicious anæmia vary in their response the optimal dosage can only be defined on the basis of a larger series.

The Dangers of Talc

CLINICAL and experimental evidence presented by A. L. Lichtman *et al.* (*Surgery, Gynecology and Obstetrics*, October 1946, 83, 531) of the Mayo Clinic, confirms previous reports concerning the deleterious effects that may arise from the use of talc as a powder for surgeon's rubber gloves. Talc is a hydrous magnesium silicate, and the commercially dispensed preparation consists of mixtures of talc, serpentine, dolomite, or tremolite. Many talc granulomas were found in tissues obtained in cases in which there were adhesions, unusual scars, nodules, sinuses or granulomas, or in which multiple operations had been performed. Thus, in 100 consecutive surgical cases in which dense adhesions resulting from multiple previous operations were present, talc crystals with a surrounding foreign body response were found in twenty-one, whilst in four cases definite talc granulomas were present. Talc granulomas were also found in five out of twenty-six operative scars in the abdominal wall which were excised because of the presence of an unusual appearing nodule or a draining sinus, whilst in five cases in which nodules developed in a thyroidectomy scar, talc granulomas were found in the nodules in three instances. In dogs, the implantation of talc around intentionally created fistulae resulted in their persistence. The conclusion is drawn that "the tissue damage caused occasionally by talc is a heavy price to pay for the preservation of a pair of rubber gloves". Potassium bitartrate was found to be a satisfactory substitute, even though it may not preserve the gloves for quite so long as talc. The possibility is mentioned of a starch that can be autoclaved being available soon which will be superior to talc.

Impetigo Neonatorum Treated with Minimal Doses of Penicillin

THE intramuscular administration of minimal doses of penicillin to new-born infants with

impetigo neonatorum is recorded by A. Anderson Aldrich and C. A. Holmes (*American Journal of Diseases of Children*, September 1946, 72, 279). Treatment consisted of immediate isolation and the intramuscular administration of two doses of 5000 units of penicillin at a three-hour interval. Definite healing occurred within twenty-four hours, followed by almost complete clearing of the skin. If any local treatment was necessary, this consisted of applying an antiseptic solution after breaking the blisters and dusting with a powder containing 10 per cent. mild mercurous chloride U.S.P. The babies so treated were returned to the nursery within thirty-six hours of the institution of treatment, and no spread to other infants occurred.

Ointment for the Relief of Chilblains

IN an article dealing with an estimation of the incidence of chilblains among Service women and the relief obtained by different methods of treatment, A. L. Winner and E. S. Cooper-Willis (*Lancet*, November 9, 1946, ii, 663) record the successful use of a palliative ointment which alone out of 78 forms of treatment was reported to give uniformly good results. The formula of the ointment is:—

Phenol . . . . .	..	1.0
Camphor . . . . .	..	6.0
Balsam of Peru . . . . .	..	2.0
Soft paraffin . . . . .	..	25.0
Hard paraffin . . . . .	..	7.5
Anhydrous lanolin . . . . .	..	10 100

Reports from the medical officers of different units indicated that application of the ointment, after immersion of the affected parts in hot water at bedtime and careful drying, resulted in decrease of pain and rapid healing.

Benzyl Benzoate in the Treatment of Chickenpox Eruption

SUCCESSFUL results obtained by the use of benzyl benzoate locally in the treatment of sixteen cases of severe itching from chickenpox eruption are recorded by J. H. Beilby (*British Medical Journal*, November 23, 1946, ii, 775). A complete application of benzyl benzoate emulsion was made to all the affected areas, except the hairy part of the scalp, for which applications of Erasmus Wilson's hair lotion were employed. The applications of benzyl benzoate were made on successive days, and relief from the itching occurred on an average of ten hours after the second application; there was no return of irritation. It was found that two applications were sufficient to complete the treatment, and no complications due to hypersensitiveness to benzyl benzoate occurred.

of scabies during a six-month period. Eurax is supplied in the form of an ointment containing 10 per cent. of croton-N-ethyl-o-toluidine, and a report of the results of experimental trials in which its action was compared with those of other anti-scabitics is given by R. Domenjoz (*loc. cit.*, 1210), of the Geigy Laboratories, Basle, who records that eurax was found to be superior in its intensity and duration of action. The method of treatment adopted in the recorded clinical series was as follows:—For ambulant patients a bath with ordinary soap and water was first given and then 50 gm. eurax was rubbed into the whole of the body, with the exception of the head (for children 25 to 40 gm., and for very corpulent patients 60 to 80 gm.); twenty-four hours later 50 gm. was again rubbed into the whole of the body, but no bath was taken. Cleansing of the body and bed linen and airing and beating of the clothes are carried out after the second application of eurax. It is most important that all contacts in a house should be treated at the same time. For those patients treated in hospital the same method was adopted except for the omission of the initial bath. It was found that the itching disappeared in most cases during the treatment period. The ointment is odourless, being almost fat-free is easily rubbed into the skin, and no burning of eroded areas occurs. A follow-up in 140 cases showed recurrence in only seven cases, and these were thought to be due to re-infection through insufficient cleansing of clothes and washing. There was no incidence of secondary eczema. It was also found that three to five treatments, with eurax applied to bandages, was effective for the healing of impetigo.

Anthallan: A New Dermatological Agent

ANTHALLAN, the lactone of beta-gallie acid-ethanol-alpha-di (n-butyl) amine, which is stated to have a certain anti-histamine activity, has been used in the treatment of a series of skin affections, most of which were cases of infantile eczema, by L. P. Ereaux and G. E. Crag (*Canadian Medical Association Journal*, October 1946, 55, 361). The drug, which is given orally, after food and in solids, as it is poorly soluble in water, is supplied in capsules of 0.085 gm. and may be given as a capsule or in powder form. In twelve cases of infantile eczema, which were followed for periods of treatment averaging 17.5 days, the mothers of the infants reported marked reduction of itching, improved sleep and appetite and lessened irritability during administration of the drug. Anthallan is stated to be safe and non-toxic and large doses can be

administered without reference to age. Originally the authors treated young infants by half a capsule four times daily, but this dose was later increased to four to six capsules per day, rising to twelve to fifteen in the twenty-four hours. A maximum dose of six capsules daily for infants, and eight to fifteen for children and adults, should be maintained for the second and third weeks, followed by smaller maintenance doses for the next two to three weeks. It was noted that better results were obtained in acute conditions, in very young children than in older patients with more chronic affections. The drug is regarded as a useful aid in cases of infantile eczema, but not as a cure, as the primary lesions do not completely disappear. Further investigations with larger series of cases is advocated.

Folic Acid in the Treatment of Megaloblastic Anæmia

ENCOURAGING results have been obtained in a small series of cases of Addisonian pernicious anæmia and refractory megaloblastic anæmia by the administration of synthetic folic acid (L. S. P. Davidson and R. H. Girdwood: *Lancet*, September 14, 1946, ii, 373). The series comprised six cases of Addisonian pernicious anæmia and three cases of megaloblastic anæmia which had proved refractory to treatment with anaphæmin. In all cases folic acid therapy resulted in the bone marrow being transformed from the megaloblastic to the normoblastic state. In the Addisonian pernicious group one patient was given 20 mgm. folic acid daily by mouth with resultant reticulocyte response and red cell rise up to the U.S.P. standard; in two patients to whom 10 mgm. were given daily by mouth the standard was reached in twenty-eight and fourteen days, and in one case in which the daily dosage was 5 mgm. the standard was reached in twenty-one days, but the rate of regeneration during the first fourteen was below standard. Another patient in this group was treated by intramuscular injection of 20 mgm. in the first twenty-four hours with resultant optimum rise on the eleventh day; a second injection of 100 mgm. was given on the fourteenth day. The sixth patient in this group a woman of seventy-nine, was given an oral dose of 400 mgm., with dramatic response; the reticulocytes rose rapidly to reach 42 per cent on the fifth day, and on the fourteenth day after the injection the red cells had increased by two million per cent. and the hæmoglobin by 42 per cent. On the twenty-first day a further dose of 100 mgm. was given by mouth. In the three cases of refractory megaloblastic anæmia folic acid therapy produced a rise in reticulocytes, red cells and hæmoglobin and transformed

Owen Thomas, the uncouth Liverpool bone-setter who became the father of modern orthopaedics; James Mackenzie, the general practitioner who became the father of modern cardiology; William Macewen, the pioneer in this country of neurosurgery, and Robert Philip, the G.O.M. of tuberculosis. To enhance the effect of his portraits Dr. Harley Williams has an opposite number for each of his subjects: Elliotson and Wakley of the *Lancet*, Thomas and Robert Jones, Mackenzie and Osler, Macewen and Victor Horsley, Philips and Trudeau. Apart from an occasional lapse into journalese, the pen pictures are effectively drawn. That of Osler is disappointingly uncritical, and the reader is advised to read the corresponding essay in Major Greenwood's "The Medical Dictator" in order to obtain a balanced view of the author of the famous textbook. The outstanding essay is that on Sir Robert Philip. Clearly based upon first-hand experience obtained as a student of this, the last of the "characters" of the Edinburgh School of Medicine, it is a masterpiece which will delight the hearts of all those who knew Sir Robert, whether as student, colleague or patient.

Practical Chemistry for Medical Students.

BY WILLIAM KLYNE, B.Sc. Edinburgh:
E. & S. Livingstone, 1946. Pp. xvi and
460. Figures 6, and a number of tables
and formulæ. Price 20s.

MUCH stress has recently been laid on the importance of the inculcation of general principles in medical education rather than the presentation of masses of detail. This counsel of perfection is in practice difficult to achieve but a notable advance has been made in Mr. Klyne's admirable book, which presents to the medical student first a general account of scientific method such as is only too seldom found in medical texts, and secondly the practical details and the principles on which they are based, for a carefully designed experimental course in inorganic and organic chemistry.

Ophthalmology in the War Years. Volume I

(1940-43). EDITED BY MEYER WIENER,
M.D. Chicago: Year Book Publishers,
Inc.; London: H. K. Lewis & Co., 1946.
Pp. xiv and 1166. Price 81s.

THIS book has been compiled for the benefit of those ophthalmologists and others who through the exigencies of war have been unable to keep in touch with current literature. Volume I re-

views all available books and articles on subjects connected in any way with ophthalmology published during the years 1940-43. It is divided into 32 sections, including sections on comparative, industrial, and neuro-ophthalmology. Each section is by a different author and is written as a coherent and connected whole, with numbered references to relevant works, which are printed at the end of each chapter. Of necessity no more than the bare conclusions of experimental work and clinical observations are given; the work is comprehensive rather than critical, and refers, of course, only to works published during the period under review. For the research worker or clinician it will be most valuable as a guide to those papers worthy of closer study. It is well produced, the index is excellent, the articles, within the limitation imposed by the fact that they refer only to an isolated three years, are eminently readable, and the editor's claim to comprehensiveness appears to be amply justified.

NEW EDITIONS

New chapters dealing with burns and amputations, and revision of the section on infection, which now includes the use of the sulphonamides and penicillin, are features of the second edition of *Surgery of the Hand*, by R. M. HANDFIELD-JONES, M.C., M.S., F.R.C.S. (E. & S. Livingstone Ltd., 20s.). The new edition is well illustrated, containing in all 104 figures.

An Introduction to Bacteriological Chemistry, by C. G. ANDERSON, PH.D., DIP.BACT., in its second edition (E. & S. Livingstone Ltd., 20s.), contains an interesting new chapter on antibiotics in which penicillin and streptomycin are dealt with in some detail. The considerable advances in chemotherapy since the appearance of the first edition in 1938 have necessitated the inclusion of a number of new drugs which have proved effective in bacterial infections.

THE inclusion of an up-to-date list of endocrine products available in Great Britain and the Colonies as an appendix to the second edition of *Textbook of Gynaecology*, by J. H. PEEL, B.M., B.CH., F.R.C.S., F.R.C.O.G. (William Heinemann (Medical Books) Ltd., 21s.) is a welcome feature. Considerable revision has been undertaken in the preparation of the new edition; new information on the investigation and treatment of sterility, and a section on the part played by the Rh factor in the etiology of habitual abortion are among the additions.

REVIEWS OF BOOKS

A Short Handbook of Practical Anaesthetics. BY H. PARRY-PRICE, M.R.C.S., L.R.C.P., D.A. (R.C.S.). Bristol: John Wright & Sons Ltd., 1946. Pp. iv and 127. Price 12s. 6d.

A MONOGRAPH of real value to general practitioners and anaesthetists: 120 pages of sound teaching show how an anaesthetic should be given for any operation, and the author leaves no doubt as to the best agent and technique. Practical details, such as the cleanliness of endotracheal tubes, and how to pass these, aseptic technique for spinal analgesia, and how to keep a patient a good colour under nitrous oxide anaesthesia, are of real value. The complications of anaesthesia, restorative measures, artificial respiration and the care of patients, are discussed in a helpful manner. The author notes the value of pentothal in war surgery, but also gives warning of its dangers for the shocked or burned patient. Common-sense advice is given on alcohol and tobacco. An excellent book—but country practitioners will not agree with the author's condemnation of chloroform, still a most valuable drug.

Jonathan Hutchinson: Life and Letters. BY HERBERT HUTCHINSON. Foreword by J. JOHNSTON ABRAHAM, C.B.E., D.S.O., M.D., F.R.C.S. London: William Heinemann (Medical Books) Ltd., 1946. Pp. 257. Plates 11. Price 12s. 6d.

ONE of the curious gaps in the medical history of England is the absence of a life of Sir Jonathan Hutchinson. The subject of one of "Spy's" famous sketches, a household name wherever medicine is practised, an intimate friend of Hughlings Jackson, a member of the medical profession distinguished as a surgeon, an ophthalmologist and a venerologist—richer material for the pen of a biographer could scarcely be imagined. Of all the giants of the Victorian era Hutchinson was one of the most outstanding, not so much because of his intellect as on account of his versatility and his strongly expressed views on such controversial subjects as reform of the College of Surgeons, the inadequacies of the medical curriculum, and the relationship of science and religion. With such a wealth of material to choose from, it is disappointing to find that so little has been made use of by his son in compiling this "Life and Letters". An act of filial piety, it throws much light upon the private life and the religious development of Hutchinson. Little effort,

however, has been made to coordinate letters, with the result that there is much repetition, and the reader is disturbed by finding himself suddenly switched from an exposition of Hutchinson's views on religion to an account of his house-building activities in Surrey. Most of the letters are intensely interesting, but it is little to indicate the great contribution Hutchinson made to the progress of medicine. The student of the Victorian era will find much of interest in this book, but its main value undoubtedly in providing material for the future biography that will one day be written of the author's famous father.

Food and Nutrition. BY E. W. H. CRUIKSHANK, M.D., D.Sc., PH.D., M.R.C. Edinburg: E. & S. Livingstone Ltd., 1946. Pp. 326. Figures 41. Price 16s.

OF books on nutrition there is no end, Professor Cruickshank combines to an unusual extent the two attributes essential in any work on the subject: a sound knowledge of scientific bases of nutrition and a facile pen. There are few nutrition experts who, having in mind as their audience "medical practitioners, medical students, those of the general public who are particularly interested . . . and candidates for the Diploma in Public Health" could produce an exposition of the subject which would meet the demands of such a varied audience. Yet this is what has been accomplished: a brief yet authoritative survey of human nutrition, couched in non-technical language. Throughout the book emphasis is laid upon the practical aspects of the subject rather than the theoretical. The final chapter devoted to an outline of the F.A.O.

Doctors Differ. BY HARLEY WILLIAMS. London: Jonathan Cape, 1946. Pp. 211. Illustrations 8. Price 12s. 6d.

DR. HARLEY WILLIAMS belongs to the romantic school of historians who believe that personality of their subjects can be more effectively conveyed by wide sweeps of the brush than by attention to minutiae. Reprehensible though the method may appear to historians reared in the Richard Lodge tradition, it is more effective for arousing the interest of the layman. As a means of illustrating how and why doctors differ the method is wholly successful, especially when the subjects chosen are John Elliott, the famous London physician who came to grief in the swamps of mesmerism; Hu-

THE PRACTITIONER

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CHRONIC OTITIS MEDIA

By I. SIMSON HALL, M.B., F.R.C.P.Ed., F.R.C.S.Ed.

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CHRONIC otitis media is a disease which is demanding an increasing amount of attention. The wastage in man and woman power during the war has brought home to us that the condition constitutes a serious social disability. The fact that in civilian life it may pass almost unnoticed is one of its greatest dangers, for its symptoms may be so slight that some sufferers are unaware even of its presence.

SYMPTOMATOLOGY

There are indeed two symptoms only—deafness and discharge—so that, provided one ear is efficient and the discharge is slight, the condition is apt to be ignored. It is also necessary to realize that there is still a great deal of indifference amongst the public to the “running ear” and that further education of mothers is necessary before the doctor will have the opportunity of treating the children in the stages at which cure can be effected. In the early recognition of ear disease in children, child welfare clinics and the school medical service can play an important and decisive part, and it is hoped that they will continue to develop this part of their work until it reaches a uniformly high standard in all parts of the country.

The most important point to be remembered is that chronic otitis media, in the vast majority of cases, is a preventable disease, and its presence can be taken to indicate negligence on the part of someone, be it parent, doctor or specialist. Every case of chronic otitis media begins as an acute otitis media and it is in this stage that it is most easily treated. Otitis media can be classed as chronic when all signs of acute inflammation have disappeared; this may take place in a matter of days or weeks.

The symptoms remaining are discharge, which varies in amount and consistency, and deafness. The hearing defect may be so slight that careful testing is necessary to determine it, but the important point is that although almost imperceptible in the early stages it will inevitably progress if the disease remains active and unhealed.

CAUSES OF PERSISTENT SUPPURATION

The causes of the continued suppuration may be:—

Disease of bone.—The original infection may have been of such severity

NOTES AND PREPARATIONS

NEW PREPARATION

ENTROSALYL.—This salicylate preparation is supplied in the form of capsules in which the sodium salicylate is enveloped in a glutinized substance for protection against the action of the gastric juices. The manufacturers are the Continental Laboratories Ltd., 101 Great Russell Street, London, W.C.1, by whom Entrosalyl is issued in packings of 50, 200, and 1,000 capsules, each containing 0.5 gm. of pure sodium salicylate.

COMMONWEALTH TRAVELLING PROFESSORSHIP

At the Buckston Browne dinner, held at the Royal College of Surgeons on November 14, 1946, a gift by a prominent New Zealand industrialist for the endowment of a Commonwealth Travelling Professorship was announced. The endowment will provide an income of £2,000 per annum for a Commonwealth Professor to be appointed each year, who will be required to travel from the country where he or she is ordinarily resident, to Great Britain, Australia, New Zealand or any other Dominion of the British Commonwealth for the purpose of lecturing, teaching or engaging in research. The object of the endowment is to forge closer links between scientific workers within the Commonwealth and thereby to contribute to Imperial unity.

THE BRITISH LEGION CONVALESCENT AND HOLIDAY HOME

The British Legion Convalescent and Holiday Home at Churchill Court, Sevenoaks, Kent, the recent gift to the Legion by the Right Hon. Winston Churchill, is now in full operation. The Home, which has accommodation for 50 ex-Service men and women, is intended for the provision of convalescent treatment for two to three weeks to enable recovery from severe illness, or for a fortnight's holiday to prevent breakdown in health. Applications for admission should be made to the local British Legion Service Committee or to the British Legion and United Services Fund Benevolent Department, Pall Mall, London, S.W.1.

NOTICES

Report of the Standing Committee on the Rehabilitation and Resettlement of Disabled Persons has just been issued by the Ministry of Labour and National Service. It deals with the Tomlinson Committee's recommendations for Reconditioning, Vocational Training and Resettlement,

which have been embodied in the Disabled Persons (Employment) Act, 1944. The Report is published, price 4d., by H.M. Stationery Office.

The British Drug Houses Ltd. are now in occupation of their new works at Poole, Dorset, which are equipped for large-scale production of Analgesic and B.D.H. laboratory chemicals. All communications concerning laboratory chemicals should be addressed to the British Drug Houses Ltd., B.D.H. Laboratory Chemicals Group, Poole, Dorset (Tel. Poole 962). The works at Graham Street and Wharf Road, London, N.1. are being reserved for the development of the pharmaceutical and medical sides of the business. *Burroughs Wellcome & Co.*—A new branch was opened on November 12, 1946, at 18 Merrion Square, Dublin. The purpose of opening the Dublin Offices is to place the scientific and technical resources of the Wellcome Foundation at the ready disposal of those resident in Ireland. *Imperial Chemical Industries Ltd.* have instituted new marketing arrangements for Southern England, and in future all correspondence from South-East England should be addressed to Gloucester House, 149 Park Lane, London, W.1, and that from the Western area to Eagle House, Colston Avenue, Bristol. *Genatosan Ltd.* have opened their premises at 65 Berkeley Street, Glasgow, C.3, as offices and an information centre for the use of the medical profession, hospitals and pharmacists throughout Scotland.

EDITORIAL NOTICES

Pamphlets.—In view of a large number of requests it has been decided to reprint the article "Diabetes from the Patient's Point of View" in pamphlet form for distribution to patients. Copies are obtainable, price 6d. each, post free.

The Practitioner Fifty Years Ago is the title of a new feature which will appear each month. In this issue it will be found on page lx overleaf.

Erratum.—In the article on "The Rhesus Factor", which appeared in Revision Corner in the November issue, line 21 on page 403 should read:—"The treatment of a child with erythroblastosis fetalis is blood transfusion with group O blood which is Rh-negative".

The contents for the February issue, which will contain a symposium on "Disorders of the Ear", will be found on page lxxiv at the end of the advertisement section.

must remember to examine the attic portion of the membrane. Even though every precaution has been taken it may still be difficult to come to a conclusion, and other examinations must be made.

Perforations of the drum head, by their position in the membrane, give some indications regarding prognosis and treatment. The location should be ascertained whenever possible. The handle of the malleus is the determining point in placing a perforation. When in front of the handle a perforation is said to be anterior, when behind, posterior, or when just around the handle it is called central. If a perforation involves the edge of the drum it is said to be marginal, and if in the upper part, that is, in the membrana flaccida, it is "attic".

In general, perforations in the anterior part of the drum indicate catarrh of the Eustachian tube and do not respond well to surgical treatment. Fortunately, they are rarely dangerous and cause small loss of hearing. The posterior marginal perforations are the least favourable, as they almost always indicate deep-seated disease which leads to loss of hearing, and require surgical treatment for their cure. It is by the ingrowing of epithelium through such a perforation that cholesteatoma most commonly forms.

Attic perforations are the most difficult to diagnose, and from the location of the disease, nearest to the middle fossa, are potentially dangerous. They cause little functional disturbance and so may give rise to complications without previous warning. The central perforation may partake of the characteristics of the anterior or posterior type, according to its precise location, and it must be examined with care for signs of chronicity, such as granulation formation.

Hearing tests.—Of all single observations, that of the hearing is the most important and this should always be examined with care, for in treatment of otitis media it must be borne in mind that preservation of hearing function is the chief aim. When there is real difficulty in diagnosis the likelihood is that otitis externa is the confusing factor. Although this condition on occasion gives rise to deafness it does not do so characteristically, and normal hearing will therefore suggest the absence of otitis media. When a degree of deafness is present the condition may still be a simple one, but investigations must continue until the diagnosis is established beyond possibility of doubt. Tuning fork tests should be employed, and if bone conduction is found to be greater than air conduction, otitis media should be presumed until the contrary is proved. Advice on diagnosis may be summed up briefly by saying that in the difficult cases, when the appearances of the drum membrane are not characteristic or when the examiner feels that he cannot trust his experience, the patient should be referred for expert opinion if the hearing is impaired.

All other symptoms which are encountered in chronic otitis media are those of complications. Headache, unilateral headache in particular, is a symptom of importance as it may indicate intracranial extension of the

that there has been bone destruction, either in the mastoid cell system or in the middle ear itself, affecting the annulus which supports the drum membrane or the ossicular chain.

Granulations may be formed after the destruction of the lining membrane of the middle ear. Or a portion of lining or granulation may become drawn through a perforation in the drum, becoming a polypus, which grows steadily until it may on occasion project from the external auditory meatus.

Cholesteatoma is caused in most cases by the ingrowth of epithelium from the external auditory meatus through a perforation of the edge of the drum membrane. As the epithelial cells become macerated and thrown off they form a mass of debris in which cholesterol crystals are deposited. This mass, although inert of itself, may, by steady pressure of growth, erode any of the vital structures surrounding the middle ear, and may even invade the brain.

Nasopharyngeal disease and *nasal disease* are more frequently encountered in children than in adults, and by constant re-infection of the Eustachian tube, particularly when violent nose-blowing is the habit, they prolong acute otitis media into chronic disease. The rendering of the nasopharynx into a healthy condition by the removal of infected adenoids, or by the treatment of sinus infection, is an obvious antecedent to the treatment of the otitis media itself.

7.3.

DIAGNOSIS

Just as the symptomatology may be obscure, because of the apparent unimportance of the symptoms, so the diagnosis may present difficulties, not only to those without special training but even to the most experienced, for the variations from normal may be slight.

Diagnosis is most frequently made by the observation and identification of the pathological condition in the tympanic membrane and middle ear.

Otoscope examination.—For the proper inspection of the drum membrane an electric otoscope is indispensable to those whose work entails infrequent examinations of the ear. This instrument short-circuits all the difficulties which are connected with the use of focused light, and although it introduces other possibilities of error the advantages far outweigh the disadvantages.

There is one prerequisite for successful examination of the ear which must be strongly emphasized, and that is proper cleaning of the external auditory meatus before examination. Lack of this precaution is probably responsible for more errors of diagnosis than any other single cause. Until the drum membrane is perfectly clean it is almost useless to attempt to form conclusions as to perforations, granulations, and the like.

Cleaning should be carried out with the ear syringe or by gentle mopping. The otoscope will then reveal the presence of a perforation, a polypus, granulations, or cholesteatoma; and with regard to the last the observer

at first to make it tolerable to the patient. As the discharge dries up, insufflations of powder, either boracic acid containing iodine (0.75 per cent.), or penicillin-sulphanilamide may be used.

Instillations.—It has become fashionable to instil penicillin solution but there does not appear to be any evidence that this is any more effective than the other remedies, and in some cases it is definitely harmful as it allows certain organisms not sensitive to penicillin to multiply at an abnormal rate. Other types of solutions of sulphonamides, some containing wetting agents, have been recommended but they do not seem to have any special advantages. The essential factor in obtaining cessation of discharge is the careful cleansing which should precede any instillation.

When sufficient skill is available, granulations or even small polypi can be destroyed with a chromic acid bead and the removal of these materially aids recovery.

Ionization is still practised with success. This consists of filling the ear with a 2 per cent. zinc sulphate solution and passing a small current (5 to 10 milliamps.) through it. A coagulum is formed of the discharge, and the secretions diminish rapidly. This method is applicable chiefly to children, and is time-consuming, for to be effective it has to be carried out with meticulous care. It has, of course, no place in the treatment of cases in which bone or other deep-seated disease is present.

The question as to how long these forms of treatment should be continued must depend upon the individual case and the response to treatment. Two to three months is not too long and may be too short.

Surgical intervention.—In the absence of bone disease the maintenance of hearing is the deciding factor in prolonging treatment or recommending a patient for radical operation. If hearing remains good, surgical treatment is not urgent, but if hearing is deteriorating, interference is demanded. The one exception to this rule is attic suppuration, for here we have a potentially dangerous condition which affects hearing to a small extent only; hence the advice previously given that the attic portion of the drum must be examined with care.

The treatment which the surgeon will select depends upon his estimate of the extent of the disease, but if he is allowed to see the patient in good time a conservative type of operation, such as the modified radical mastoid, will be selected. This will eradicate disease and remove danger, and at the same time will ensure the preservation of any hearing which remains, whilst the more destructive operation, the radical mastoid, will be avoided.

These operations are still much too common in otological clinics and their number could be greatly reduced by efficient treatment of the early "acute ear", but even when carried out they should yield upwards of 80 per cent. of dry healed ears. Results still fall far short of this, but with understanding and cooperation on the part of the parents, family doctor, and specialist, a high percentage of success should normally be achieved.

disease. Giddiness and sickness indicate labyrinthine involvement and the possible need for surgical treatment. There are many other signs and symptoms which may result from extension of disease and inflammation in the course of an acute exacerbation of chronic infection, but they are outside the scope of this article.

TREATMENT

Consideration of the pathology of otitis media makes it obvious that in a complicated structure such as the middle ear, disease having its origin in any of the more remote parts is quite beyond the reach of external medication and, apart from operation, nothing except the natural recuperative powers of the patient is likely to be of value. Treatment is therefore directed towards assisting nature.

It is sometimes found that a polypus, by blocking an opening through the drum membrane, dams back discharge and makes the proper drainage essential to recovery impossible. By, so to speak, drawing the cork out of the bottle, in the removal of the polypus, recovery can be materially aided.

Treatment resolves itself into attacking the disease in superficial and accessible situations or helping the individual to make the best use of his ability to repair damage.

The question will immediately be asked as to what part *chemotherapy* can play in reaching otherwise inaccessible disease. The answer can be given without hesitation that chemotherapy is more likely to do harm than good, for so far as present knowledge goes there seems to be little influence by either penicillin or the sulphonamides on chronic disease within the middle-ear cleft. Chemotherapy is no substitute for surgery in chronic disease, but it is one of the most powerful weapons against complications. The time for its use is in the early acute stages, and when complications have given rise to dangerous spread of infection.

When a patient suffering from chronic otitis media is first seen an attempt should be made to discover the reason for the continued discharge. If any of the more serious conditions detailed are diagnosed then the patient should be referred for surgical opinion.

Cleansing of the ear.—If, however, the presence of granulations or other signs of deep-seated disease cannot be ascertained with certainty, then treatment should be planned to assist nature as far as possible by the maintenance of cleanliness of the ear. The discharge should be removed regularly and completely by instilling peroxide of hydrogen and syringing with mildly antiseptic solution, such as boracic lotion daily or at longer intervals, according to the amount of discharge present. The more copious the discharge the more frequent will be the cleansing required. After syringing the ear clean, it should be mopped as dry as possible and treated with drying drops, e.g. "industrial" spirit containing boracic acid, 8 grains (0.52 gm.) to the ounce (28.4 c.cm.) of spirit. This may have to be diluted

(3) *The sclerotic type.*—There is almost complete absence of cells and cancellous bone. This type of process is commonly met with in operations on chronic suppurations of the middle ear, but the sclerosis is not necessarily due to the suppurative process but may be a congenital condition. Acute mastoiditis in this type of bone does not present the usual physical signs because the pus cannot make its way through the dense bone to the surface. In a virulent infection it is easier for the pus to pass through the walls of the antrum and thus to infect either the middle or posterior fossa of the skull.

The mastoid antrum is part of the middle-ear cleft and is in direct continuity with the other parts of the cleft, the tympanic cavity and the Eustachian tube. Mastoid infections are always secondary to suppurations in the tympanum, and although cases of mastoiditis have been described with a normal drum membrane there is evidence that a tympanic infection has preceded the onset of the mastoiditis. Cases in which the infecting organism is the *Streptococcus mucosus* may run their course with an intact drum-head, although at the same time there may be extensive disease in the mastoid process.

The mastoid antrum should be looked upon as an extension of the tympanum, and pus produced in the tympanum can readily pass backwards to the antrum. This is not a true mastoiditis and only becomes so when the infection spreads to the remainder of the process. This spread may be quick or slow, depending upon the structure of the process: quick in the case of a cellular mastoid and slow in the cancellous or the sclerotic type. As already pointed out, the signs of an acute mastoiditis will occur earlier in the cellular bone, and indeed physical signs may be dangerously delayed in the other two types of bone.

ACUTE MASTOIDITIS

The symptoms and signs of acute mastoiditis are grafted on those of the preceding tympanic suppuration and it is well to consider what these symptoms are.

Pain.—Following the relief of the initial pain, brought about by rupture of the drum-head or by the operation of myringotomy, there may be recurrence of the pain. This may be deep-seated and severe or the complaint may be no more than one of soreness or discomfort. Pain tends to be worse at night so that the patient suffers from insomnia.

Fever.—Generally the temperature is not much elevated and does not exceed 99° F. (37.2° C.), although in children it may be higher. Cases are frequently seen in which there has been no elevation of temperature, although at operation the mastoid is found to be extensively diseased. The absence of fever is therefore not of real diagnostic value. Indeed, with other symptoms of mastoiditis present, a high temperature would suggest some complication, such as an extradural abscess or infection of the meninges.

INFECTIONS OF THE MASTOID

By J. H. COBB, M.B., F.R.C.S.

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THE signs and symptoms of mastoid infections vary according to the anatomy of the mastoid process, and the course of the disease is often dependent upon the structure of the bone. It is therefore useful here to give a brief account of the various types of the mastoid bone which are met in practice and to indicate how the course of the disease may be modified by the structure of the bone.

At birth, the mastoid part of the temporal bone consists only of the mastoid antrum; the mastoid process and mastoid air-cells are still undeveloped. The antrum at birth is both actually, as well as relatively, larger than that of the adult antrum. The mastoid process grows downwards from the antrum and assumes the adult type in the third to the eleventh year. The fully developed mastoid process may be massive or form only a short protuberance. Its internal structure is also variable and several types of the mastoid process are found.

(1) *The cellular type.*—In this type the mastoid process is formed of cellular spaces which are lined by mucous membrane. Commonly there is a large cell towards the tip, and in acute mastoiditis this is frequently found filled with pus. In this type the cortex of the mastoid is thin, and therefore in acute infections œdema or even a subperiosteal abscess tends to be an early sign. In cases with large infected cells at the tip the pus may erode through the tip of the mastoid and form an abscess deep to the sternomastoid muscle (Bezold's mastoiditis), or pass forwards along the digastric muscle and form a lateral retropharyngeal abscess. The cells may not be confined to the process and in some cases extend beyond:—

(a) Forwards into the zygoma and into the squama. Cases of infection in this type will have a swelling in the temporal fossa, with or without œdema of the face and eyelids (zygomatic mastoiditis).

(b) Into the petrous temporal bone surrounding the labyrinth or even to the tip of the petrous bone. The Gasserian ganglion lies in a hollow near the apex of the petrous pyramid and the sixth cranial nerve crosses the tip of the petrous bone. Infection of the petrous cells may cause neuralgia of the fifth nerve and paralysis of the sixth nerve, with a resulting squint and diplopia (Gradenigo's syndrome).

(2) *The diploetic type.*—In this type, instead of the formation of cells, the interior of the mastoid process is filled with cancellous bone similar to that found between the inner and outer tables of the cranial bones. In such mastoids, signs of acute mastoiditis tend to be later in appearance than in the cellular bones.

the swelling occupies the temporal fossa and œdema may spread into the face. Comparable to the subperiosteal abscess is the condition known as Bezold's mastoiditis. In this condition pus has broken through the bone near the tip and has formed an abscess deep to the sterno-mastoid muscle in the neck. The formation of subperiosteal abscess is more common in infants and young children, since it is mainly an antral infection and the cortex is very thin.

TREATMENT OF ACUTE MASTOIDITIS

A large proportion of the cases of acute mastoiditis will with careful treatment recover without operation on the mastoid. The patient should be confined to bed, and regular swabbing of the meatus with cotton-wool mops should be adopted. If drainage through the drum-head is inadequate a freer outlet should be provided by the operation of myringotomy. If the discharge as well as pain and tenderness are lessening day by day the outlook is favourable and recovery can be expected. There are, however, certain signs and symptoms which indicate the necessity for operative treatment :—

(1) The presence of a subperiosteal abscess or of considerable œdema. Cases in young children with a small amount of œdema sometimes recover quickly under treatment.

(2) Marked tenderness on pressure which does not tend to diminish and which is elicited from a widespread area and not confined to the region of the antrum.

(3) Continued fever in the absence of any other cause, accompanied by tenderness and aural discharge.

(4) Persistence of copious discharge, notwithstanding efficient local treatment. After swabbing out the ears of such patients there is a rapid reappearance of the discharge with pulsation, which again fills the meatus.

(5) Œdema or sagging of the postero-superior meatal wall.

(6) Any indication or threat of an intracranial complication.

CHRONIC INFECTIONS

Chronic infection of the middle ear is the term applied to those cases which have a perforation of the drum-head through which there is an almost constant discharge of pus and which shows no signs of healing. These chronic infections are the result of an acute infection or of a series of acute infections which treatment has failed to cure. It may be that the patient has not presented himself for treatment, or he may not have continued it long enough. Some of the chronic cases are, however, due to the severity of the initial infection, especially in the more virulent types of scarlet fever, measles, and diphtheria. In these more severe cases there is a rapid destruction of the drum membrane and infection of the bone, such as caries of the malleus and incus and parts of the temporal bone. It may be stated that

Aural discharge.—A free discharge may cease suddenly without any improvement in the patients' symptoms or even with an increase of the pain. This temporary cessation may be followed by an even more profuse purulent discharge. The discharge may become more copious, so much so that an infection of the antrum and cells, to account for the large amount which is being secreted, may be assumed.

Drum membrane.—This usually presents a red, swollen, or even bulging appearance. Often the superior wall of the external auditory canal is red and swollen and seems to be continuous with the swollen drum. This sagging of the postero-superior wall of the meatus is a valuable sign of mastoiditis and is most marked when the upper part of the tympanic cavity is affected.

Mastoid tenderness.—This symptom is the most valuable in the diagnosis of acute mastoiditis and to some degree is present in most cases. Tenderness varies from that elicited by a light touch to the cases in which pain is caused only by deep pressure. Usually tenderness is greater and appears earlier in the cellular type of bone and is less and longer delayed in the cancellous and sclerotic bone. Tenderness is commonly greatest over the mastoid antrum, but in some cases the maximum point is towards the tip or along the posterior border of the process.

Post-auricular œdema.—When the suppuration reaches the mastoid cortex the inflammatory process spreads through the bone and œdema of the soft parts occurs. Children, who have a relatively thin cortex, show this sign more frequently than adults, and it is a very early sign in the mastoiditis of infants. Post-auricular œdema commonly occurs in infective lesions of the external auditory canal, especially with boils on the posterior wall. The combination of a discharging boil and œdema over the mastoid process thus simulates an acute mastoiditis. Usually it is not difficult to distinguish between the two conditions. On otoscopic examination in the case of a furunculosis, the swelling of the canal is evident and the discharge is seen exuding from this swelling. If the drum-head is visible it may appear normal or at least be intact. Manipulations of the auricle elicit pain in the case of meatal infections but are painless in the case of mastoiditis. Pressure over the œdematous area in furunculosis, provided care be taken not to interfere with the auricle, is painless, whereas pressure similarly applied in a case of mastoiditis causes pain. In furunculosis the retro-auricular groove is obliterated, whereas in mastoiditis the groove is always present. Occasionally the diagnosis is more difficult, and of course the two conditions may occur together.

Subperiosteal abscess.—Suppuration in the mastoid causes a perforation of the cortex; pus collects under the periosteum, which is raised from the bone and a large external swelling is formed. This gives rise to a displacement of the auricle, which is pushed forwards or, if the abscess is a little higher, forwards and downwards. In cases in which cells are present in the zygoma

of exuberant granulations which bleed readily and through which bare bone can be felt by a probe is diagnostic of necrosis of bone. Aural polypi may be almost any shape and size consistent with the antro-tympanic cavity and external meatus. They may be single or multiple, may be masses of vascular granulation tissue or may become more organized and covered with a layer of epithelium. Frequently, polypi arise from the tympanic ring, but they may arise from necrosed ossicles, from the attic and from the inner tympanic wall. A rapid recurrence of granulation tissue or polypi after removal denotes an active osteitis and indicates that more radical measures should be undertaken.

Many of the cases of chronic otorrhœa are due to reinfection from the nasopharynx *via* the Eustachian tube. This type of case is more common in children and is frequently due to infected tonsils and adenoids or to infections of the maxillary antra. The discharge is mucoid or mucopurulent and tends to become profuse during exacerbations of the causative primary focus. Between attacks the ear is dry and the perforation may heal. In these cases the perforation is usually in the antero-inferior quadrant of the drum-head; there are no signs of bone infection, such as granulations; there is usually neither pain nor tenderness. In this type of case treatment should be directed to the infecting focus, in addition to the regular toilet of the ear.

Chronic infections of the mastoid process give rise to a constant discharge which is often offensive. Apart from the discharge there are usually no symptoms. From time to time, however, attacks of mastoid pain and tenderness occur with some elevation of temperature. These attacks are due to obstruction to the outflow of the discharge, and the discharge may cease or become scanty. When the discharge restarts, symptoms are relieved. The perforation in this type of case is placed posteriorly and in the upper quadrant of the drumhead.

In the attic type of disease the membrana tensa may be intact; the perforation is in Shrapnell's membrane. The discharge is scanty but malodorous, granulation tissue is present and there may be a mass of cholesteatoma. Attic disease is very resistant to treatment because of the anatomical peculiarities of the attic. Containing as it does most of the ossicular chain with its joints, capsules and ligaments, drainage is inefficient. It must be remembered also that the attic is separated from the middle fossa of the skull by the thin tegmen tympani only, so that intracranial complications may at any time arise.

In another severe type of chronic infection of the mastoid there is a large destruction of the drum membrane, the discharge is profuse and offensive, and there may be multiple polypi arising from the tympanic ring or even from the aditus and inner tympanic wall. In this condition the patient frequently complains of pain referred to the same side of the head, accompanied by vertigo if the labyrinth is involved.

most cases of chronic infection are the result of neglect or the lack of skilful treatment.

Symptoms.—Chronic suppuration of the middle ear may exist for years with very few symptoms. The patient complains of nothing more than discharge and some impairment of hearing; usually the general health is unaffected. The discharge is often scanty, so scanty as to form only a crust around the perforation or on the meatal wall. It may be more profuse, and there are periods when the discharge increases in amount. In acute infection of the ear the discharge is generally odourless but in chronic infections it is offensive, often so offensive as to be a source of complaint. It may be blood-stained or may contain masses of epithelial debris.

The position of the perforation is of importance. It may be central, that is, with intact drum membranes around it, or it may be marginal so that there is destruction of the peripheral edge. It may be in Shrapnell's membrane and therefore leading into the attic region of the tympanum.

Central perforations, which are the most common, vary in size from a small round hole to nearly complete destruction of the drum membrane. Often they are crescentic and affect both anterior and posterior segments. Marginal perforations are potentially of more serious import than the central ones. This is especially true of those that affect the postero-superior quadrant and Shrapnell's membrane. In the first place, the bony margin of the tympanic ring is infected, and when the perforation is in the postero-superior position there is a ready access to the attic, aditus and antrum. It is through a marginal perforation that the epithelium of the meatus tends to grow into the antro-tympanic cavity.

This ingrowth of epithelium may be looked upon as nature's attempt to localize the lesion, and cases are seen in which this process has come about. On the other hand, this ingrowth of epithelium may lead to a much less favourable condition, i.e., the formation of a cholesteatoma. When the epithelium spreads into the aditus and antrum and meets with a focus of infection the superficial cells are exfoliated and, mixed with pus, form a putty-like mass. There is still the underlying active layer of epithelium, so that this process is repeated. Eventually a large mass may be present in the cavity of the mastoid which by constant increase exerts pressure on the surrounding walls, causing their absorption and thus exposing the dura mater of the middle or posterior fossæ of the skull and lateral sinus. There may be absorption of the inner wall of the tympanum, exposing the labyrinth. In this way such complications as an extradural abscess, cerebral or cerebellar abscess, lateral sinus thrombosis, and labyrinthitis are produced. Fragments of cholesteatomatous material are found in the meatal pus or a mass may be seen presenting through a perforation.

Granulations and polypi.—When the chronic suppurative process has destroyed the mucosa the underlying bone is infected and the formation of granulation tissue, which grows into an aural polypus, results. The presence

OTOSCLEROSIS

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THE most common cause of severe deafness in adults is otosclerosis and, until recently, this disease resisted all attempts to improve or even arrest the progress of the deafness. The unfortunate sufferers slipped slowly into their lonely world of silence, and no form of treatment—and many had been tried—ever had any lasting influence, so that lipreading and, wherever practicable, hearing aids were the best that the otologist could offer. In consequence, many sufferers from otosclerosis, knowing this, never sought special advice.

Recently, however, great advances have been recorded in the surgical relief of deafness due to otosclerosis, and the possibility of improvement of the hearing by surgical means has given new hope to the deafened and attracted the attention of all who are interested in their welfare. It is therefore the purpose of this short article to give an outline of otosclerosis and its management, with particular reference to the operative treatment of the deafness.

PATHOLOGY

Otosclerosis is really a disease of bone in which the dense bony capsule surrounding the internal ear, the labyrinth, is in parts replaced by an overgrowth of spongy bone. The favourite site for foci of otosclerotic bone are on the inner tympanic wall, and from here they can easily spread to the region of the oval window. Once this has happened, bony ankylosis of the stapedio-vestibular articulation is likely to result, so that the movement of the footplate of the stapes in the oval window in response to sound waves is impeded, and deafness results. As the spongy bone spreads around the oval window, movements of the stapes are even further hindered and the hearing becomes worse.

As the deafness in otosclerosis is due to binding down of the stapes by the spongy otosclerotic bone, it is not surprising to learn that this disease is asymptomatic until the bony overgrowth reaches the stapes, when deafness supervenes. Guild (1944), in an examination of the temporal bones from 1,161 routine autopsies, found foci of otosclerotic bone in 49 cases but in only 10 instances was the stapes ankylosed. Thus it is necessary to make a clear distinction between histological and clinical otosclerosis and to bear this in mind when considering the part played by heredity in the disease (see page 110).

CLINICAL FEATURES

Clinical otosclerosis is seen nearly twice as often in women as in men and the deafness is most frequently first noticed in late adolescence. The onset

TREATMENT OF CHRONIC INFECTIONS OF THE MASTOID

It is well known that many of these cases of suppuration go on for years with nothing more than discomfort due to a slight aural discharge and some loss of hearing. On the other hand, there is the possibility of intracranial complications arising which may prove fatal. The radical mastoid operation should render the ear "safe", but such an operation tends to increase the deafness. It is obvious, however, that if symptoms suggesting an intracranial complication arise, radical treatment must be adopted and the resulting loss of hearing disregarded.

Conservative treatment consists in regular and thorough toilet of the ear by means of cotton-wool mops, followed by the instillation of spirit drops or by the insufflation of powders, such as boracic acid or boracie acid and iodoform. Foci of infection in the nose and throat must be eliminated, and removal of a polypus or a mass of granulation tissue carried out. During the second world war otologists in the Forces have reported excellent results by adopting the regular and expert treatment of the chronic infected ear; in large numbers of cases the ears have become dry and in some instances healed.

If the case is one of an infection mostly confined to the mastoid, with repeated exacerbations of pain and tenderness, the cortical mastoid operation should be performed and the diseased cells removed.

Radical treatment should be adopted in those cases in which loss of hearing is already great, in an attempt to clear up the disease, even though there is no other indication for the radical operation. When symptoms pointing to an intracranial complication arise there is a clear indication for radical operation. Such symptoms are:—

- (1) Recurrent attacks of pain in the ear and side of the head.
- (2) Attacks of vertigo.
- (3) Facial nerve paresis or paralysis.
- (4) Rapidly recurring granulation tissue or polypi on the inner tympanic wall, especially when manipulation of these causes vertigo.
- (5) Profuse and foul-smelling discharge which resists conservative treatment.

SUMMARY

The signs, symptoms and course of mastoiditis vary with the anatomical structure of the mastoid process.

The indications for operation in acute mastoiditis are discussed and also the treatment of chronic suppuration and indications for operative procedures.

treatment, it is important to examine carefully the integrity of the nerve of hearing, as any great impairment of this is a contraindication to operation.

Noises in the head or ears are usually noted, although it is surprising how few patients with otosclerosis find these noises troublesome, except when they are very tired or worried. *Vertigo* is rarely complained of and in other respects these patients are usually remarkably free from disease. The ears appear quite normal and there is no evidence of Eustachian insufficiency. It is said that the ear canals of otosclerotics are remarkably free from cerumen, but this is by no means always so. The ear drums themselves are normal in appearance and may be even more translucent than usual. The pink tinge, that has already been mentioned as being seen in certain cases, is said to be due to increased vascularity on the inner tympanic wall which is visible through the translucent membrane.

It is probable that foci of otosclerosis may occur in conjunction with other ear diseases, catarrhal or suppurative, and also in certain general diseases of bone, such as osteitis deformans and osteogenesis imperfecta, but these are beyond the scope of this present article, which is only concerned with uncomplicated cases of clinical otosclerosis.

Thus, clinical otosclerosis presents a conductive type of deafness in which the visible parts of the auditory apparatus appear to be quite healthy, and for which no cause can be found apart from heredity.

TREATMENT

General.—Many forms of treatment have been tried and temporary success has been claimed for some. Until recently, however, it may be said that no form of treatment offered any substantial prospect of improvement in hearing. Hearing aids have been a great stand-by and the advent of the modern valve amplifier has worked wonders in enabling the deafened patient to hear again. Now that these amplifiers and their batteries have been reduced to the size of a cigar-case, or even smaller, and in this form are easily wearable, many of the objections to the use of aids have been overcome. With such an aid a conductive-deafened patient can hear conversation, both intimate and general, and can often hear long-distance speech, as in Church and at the theatre. Nevertheless, few of these patients would not prefer some form of treatment that would enable them to hear, as they term it, “naturally”, rather than use an aid.

Surgical.—The idea of breaking through the bony barrier that prevents sounds from reaching the normal organ of hearing has attracted the attention of otologists since the last century, and workers in many countries devoted themselves to this problem. At first, efforts were directed towards the area of disease, and the stapes were removed or a new window was drilled in the cochlea. None of these attempts was successful and it was not until windows had been made in the semicircular canals that some promise of real improvement was held out. In this country the earliest worker along these lines

may, however, be insidious, so that the exact time when the deafness first starts may antedate the stated onset. In a considerable proportion of cases the deafness is not noticed before the age of twenty or thirty, or even later, and it is very rare to find it starting before puberty. In a few fortunate cases one ear only may be attacked, but as a rule those presenting themselves for examination have both ears affected, one being worse than the other, although often the difference between the two is not so great as the patient thinks. A history of similar deafness in the family can be elicited in about half the cases. As the proportion of cases of otosclerosis in which a clinical diagnosis can be made is only a fraction of those in which otosclerotic foci are really present, no accurate statement can be made about the frequency with which this disease is transmitted, but it is probable that 50 per cent. is the lowest figure, and it may be that in nearly every case the disease is handed down from parent to child.

Guild (1944) also found that otosclerosis was at least ten times as common in whites as in negroes and, in this connexion, it is interesting to note how frequently the disease is seen in the very fair-haired.

The deafness is progressive but the rate of the progress varies greatly. In many, after an initial deterioration, the hearing seems to remain stationary for one or more decades, whilst in others the hearing may deteriorate rapidly to almost complete deafness within a few years. Such cases as these often exhibit a *pink-tinged ear drum* and have been aptly described as "otosclerosis malignans". Pregnancy usually makes the hearing worse, although after the puerperium the hearing may improve a little, but it rarely reaches its former level. Severe illnesses of any kind may also affect the rate of progress unfavourably. The deafness is, of course, of the conductive or middle-ear type, at any rate in the early stages of the disease. Therefore as the patient has a normal organ of hearing, and as he does not hear outside sounds very well, his voice tends to be quiet and he loses the reflex that makes the normal-hearing person raise his voice when speaking in the presence of a noise. This accounts for the phenomenon first noticed in the 17th century by the Englishman, Willis, and called "*paracusis Willisii*", in which the conductive-deafened patient hears better in noisy surroundings. Another feature of this type of deafness is tolerance of amplified sounds. This is a blessing in these days when so much hearing is contingent upon amplified sound (radio, cinema, telephone), and is of great assistance in prescribing a hearing aid.

In long-standing cases of otosclerosis, and in certain of the more severe instances of the malignant type, there may be evidence of *perceptive (nerve) deafness* as well. This is particularly evidenced by an alteration in the timbre of the voice, intolerance of amplification and disappearance of paracusis. The ability to perceive bone-conducted sound is also reduced in nerve deafness, but it may be that reduction of bone conduction can also occur with an intact nerve. As will be seen in considering the possibility of surgical

sound that it will be called upon to perceive after a successful fenestration.

Mention has already been made of certain indications of involvement of the nerve, and it must be emphasized that voice changes, intolerance of amplification and disappearance of paracusis, and very often loss of acuity for bone-conducted sounds, are sinister portents whose significance should not be disregarded when assessing suitability for operation. The results of this operation as regards hearing will, of course, be governed by the clinical judgement and technical ability of the surgeon. If these are beyond reproach it would be fair to say that at least half the patients operated on will retain a substantial improvement in hearing for two years or more: an immediate improvement in hearing is likely in more than three-quarters but, for one reason or another, this improvement is not always maintained. If, however, the hearing remains good for six months after the operation, the danger of deterioration from bony or fibrous closure of the fenestra has largely disappeared. It is too early yet to say for how long improvement can be maintained, but cases in which the hearing has been retained for as long as seven years have been recorded. Variations in technique that have been described of recent years and will, no doubt, continue to be developed, are all concerned with increasing the chance of permanent, satisfactory improvement in hearing, and it is hoped that time will substantiate some of the claims already made for an 80 per cent. chance, or even more, of long-term, worthwhile improvement. It must be appreciated that fenestration will not restore the hearing of an otosclerotic to normal and it is fair to assume that on an average there will be an improvement of 25 decibels* for the critical speech frequencies (512, 1024, 2048). Thus a patient with a 50 decibel loss for these frequencies—and this is a frequent finding and usually means that conversation can only be heard from about 1 foot away—can expect to be improved to the 25 decibel level, which will mean that he can hear speech comfortably from 10 feet away. In other words, his hearing will have been restored to a practical level.

For patients with a much greater initial loss of hearing than 50 decibels, the benefit that they are likely to experience will be limited, and they must be warned of this accordingly.

Fortunately, the operation is not dangerous, infection being rare and the risk to life negligible. In a small number of cases, somewhere in the region of 5 per cent., the hearing in the operated ear may become worse, and very occasionally may even be lost. For this reason it is usually considered advisable to operate on the worse hearing ear. If it turns out that the hearing in this ear is improved, then the possibility of operating on the other ear at a much later date can always be entertained.

* It is impossible to translate this accurately into percentage loss as the decibel is a logarithmic unit of sound measurement and represents a 25 per cent. difference in sound energy.

was Jenkins (1913), and he was shortly followed by Holmgren of Sweden, who, in 1917, despite many setbacks and disappointments, persevered until finally he was able to report a certain number of lasting successes. Sourdille (1932) of Nantes believed that the road to success lay in making an artificial window in the external semicircular canal and covering this with a flap of skin continuous with the intact tympanic membrane. In this way sound waves striking the tympanic membrane would cause it to vibrate and these vibrations would be transmitted to the labyrinthine fluids *via* the artificial window. His operation was performed in two or three stages, spread over several months, to lessen the chance of infection. In 1938, Lempert of New York described a procedure similar in principle to that of Sourdille but performed endaurally and in one stage. By this technique, danger to function or to life from infection proved to be negligible and the results were most promising. Certain modifications in technique were made and the artificial window, or "fenestra", as it was termed by Lempert, was brought further forward, so that it lay above the oval window opening into the vestibule and adjacent ampulla of the lateral semicircular canal. Additions to, and modifications of, Lempert's technique of the "fenestra nov-ovalis" have been practised and suggested by Lempert himself and others, and a recent paper by Shambaugh (1946) of Chicago, offers several interesting variations of detail.

Having seen all the surgeons mentioned (except Sourdille) at work, I noted that all paid great attention to the tiniest detail of technique and that they were all ready to consider and to work out any modification that might lead to better results. It is therefore by no means certain that the final form of the operation has yet been reached. The procedure which is now usually known as "fenestration" is a delicate operation, calling for special equipment, special experience and special time. It should never be undertaken as a routine operation as part of a long list. Only those surgeons who have been trained or have trained themselves specifically in this work are likely to achieve satisfactory results. Among other things, it is usually found desirable to work in a magnified field and a binocular dissecting microscope giving 5 or 10 diameters of magnification is found by many workers to be of the greatest help. It has been found that one of the major hindrances to permanent success has been the tendency for bone to grow over the fenestra, and many of the technical modifications have been directed towards preventing this.

If the nerve of hearing is affected to any great extent, fenestration will not help, because no matter how perfectly the sound waves are conducted through the newly made fenestra, and no matter how patent the fenestra remains, little benefit will accrue if the organ of hearing is unable properly to appreciate the sounds that are conducted to it. It is therefore of prime importance when selecting cases for operation to be quite sure that the organ of hearing retains sufficient function to benefit by the increased

OTITIS EXTERNA

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INFLAMMATORY affections of the external auditory meatus were responsible for great wastage of manpower during the last war, especially amongst troops serving in tropical and subtropical climates. Many medical officers called upon to treat these cases experienced difficulties in both diagnosis and treatment, and it is hoped that this article may prove helpful to the civilian practitioner confronted with similar problems.

Skin infections of the outer ear and its neighbourhood are many and varied and it is not proposed to discuss conditions such as intertrigo of the retro-auricular fold, impetigo, acute eczema and erysipelas, all of which affections present characteristic features in any skin area they may involve. Attention will be confined to those conditions which affect principally the skin of the auditory meatus and which are generally accepted as being embraced by the title "otitis externa".

CLASSIFICATION

The various forms of external otitis may be acute or chronic. They may arise primarily in the auditory meatus or be secondary to underlying suppurative otitis media. They may exist singly, or appear in combination. They are frequently difficult to cure and often tend towards recurrence. The following classification is submitted on the grounds of simplicity, and the therapeutic measures advocated under the different headings are those which personal experience has proved of value in the treatment of large numbers of cases under Service conditions.

(1) *Acute*

- (i) Circumscribed external otitis, or furunculosis of the external auditory meatus.
- (ii) Diffuse external otitis.
- (iii) Hæmorrhagic external otitis.
- (iv) Otomycosis.

(2) *Chronic*

ACUTE CIRCUMSCRIBED EXTERNAL OTITIS: FURUNCULOSIS

Furunculosis of the auditory meatus is a staphylococcal infection of the hair follicles and occurs therefore only in the outer part of the meatus. Any swelling confined to the inner third of the meatus is not a furuncle.

The *etiology* is as in furunculosis elsewhere. Predisposing causes include fatigue, general debility and inadequate diet. In any case of furunculosis the possibility of diabetes mellitus should not be overlooked. Suppurative otitis media may be an underlying factor. The exciting cause is almost

As the fenestra is made in the vestibular portion of the labyrinth, a certain amount of post-operative dizziness is inevitable. This, however, rarely proves troublesome after the first week and usually disappears within two months. The operative field is adjacent to the facial nerve, so that facial palsy may sometimes be seen, but as yet in all the reported cases—and they are fortunately few—the palsy has been transient. The operation involves a stay in hospital of about two weeks, and many patients are able to return to work within a month, although it is always necessary for them to be able to attend for after-treatment until the operative field has healed, and this takes at least six weeks.

The principal *contraindications* to the operation are internal ear changes and any active infection in the middle ear or upper respiratory tract. It should always be insisted that the patient himself should decide about the operation after the facts have been presented to him and he has had an opportunity of discussing them with his family and his doctor. At the same time, it is only fair to point out that in most instances the benefit obtained from an operation is no greater than that offered by a good hearing aid. Nevertheless, the prospect of natural hearing being restored, and the stimulating effect upon the patient when it is, are a great encouragement to both patient and surgeon, and the amount and duration of improvement in hearing, in suitable cases, are such as to justify performing the operation in selected cases at the patient's request.

CONCLUSION

The end of the story has yet to be told but the practitioner need no longer dread having to turn his otosclerotic patients away without any prospect of relief. Now, with a really efficient and easily worn hearing aid or with surgery, it is possible to increase the auditory horizon of all those handicapped by deafness due to uncomplicated otosclerosis and to enable them to re-enter and to enjoy the world of hearing.

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invariably a local abrasion sustained by scratching with the finger nails, match-sticks, hairpins or kirbygrips in attempts to relieve irritation or remove wax, or resulting from the injudicious use of the aural speculum. Many cases of external otitis follow bathing in infected swimming pools.

Among the important *symptoms and signs* are:—

Pain.—A feeling of irritation or discomfort in the ear is usually followed quickly by the onset of pain. This soon becomes continuous and is often severe, the tissues of the meatus being relatively inelastic and abundantly supplied with sensory nerve endings. The pain is aggravated by movements of the pinna and the lower jaw.

Tenderness.—The region around the meatus and auricle is tender on pressure, especially in front of the tragus. Gentle pressure with a probe in the meatus will elicit a localized point of maximum tenderness. If care is exercised not to displace the pinna during palpation it will be found that there is no true mastoid tenderness.

Swelling.—Œdema around the auricle is often present and the retro-auricular groove may be obliterated. The walls of the meatus are swollen and the peri-auricular glands are enlarged.

Hearing.—Unless absolute stenosis of the meatus occurs the hearing is seldom affected and is often normal.

Discharge.—Rupture of the furuncle may occur spontaneously, with great relief of pain. The discharge is purulent and is usually thick and scanty; it may be thinly streaked with blood.

The tympanic membrane.—Swelling of the meatus or the presence of pus and debris may hinder examination of the drumhead, but gentle cleansing of the meatus and careful use of a small speculum will usually reveal a normal tympanic membrane.

Pyrexia, if present, is only slight.

Diagnosis.—In any case of otorrhœa it is of paramount importance to decide whether the infection is confined to the outer ear or whether it originates in the middle-ear cleft.

It is common for insufficient attention to be paid to the degree of deafness present in patients complaining of aural symptoms. If the hearing is normal, then the middle ear is not the seat of active infection and the presence of mastoiditis can be excluded almost with certainty.

Every effort should be made to obtain a view of the tympanic membrane in these cases, because a drum which appears normal in colour and lustre will provide confirmatory evidence of the absence of otitis media. The inexperienced frequently confuse furunculosis of the external auditory meatus with otitis media and mastoiditis, but errors in diagnosis should be practically eliminated if the symptoms and signs are carefully assessed, particular attention being paid to the hearing power and the appearance of the drumhead.

Treatment.—General treatment is as for furunculosis elsewhere in

the body, but special attention should be directed to the administration of adequate sedatives in these often very painful aural cases.

The essentials of *local treatment* are thorough cleansing of the meatus, evacuation of pus from the boil, and sterilization of the meatal skin. The preliminary cleansing should be done under direct vision, employing an adequate source of illumination, an aural speculum and a wool-tipped probe soaked in rectified spirit. When all wax and debris have been removed from the meatus a wick of narrow ribbon gauze, impregnated with either 10 per cent. ichthyol in glycerin or glycerin and magnesium sulphate paste, should be gently but firmly inserted as far as possible into the meatus. The wick is left *in situ* for twenty-four hours and then removed, when it will be found that the meatal swelling has been reduced considerably. It is common also to find that the inflammatory process has become more localized and the furuncle may even be pointing. The meatus is thoroughly cleansed once more and another and larger wick inserted for a further twenty-four hours. Spontaneous rupture of the furuncle may occur and all that remains to be done is to continue daily cleansing of the meatus and sterilization of the skin in order to prevent infection of additional hair follicles. For this latter purpose the application of a 1 per cent. solution of gentian violet will be found useful.

If the above sequence is carried out efficiently the furunculosis will usually subside satisfactorily, but if spontaneous rupture fails to occur and severe pain persists, incision may be necessary. This should be done under general anæsthesia, for which purpose nitrous oxide and oxygen or intravenous pentothal are most satisfactory. Local freezing with ethyl chloride is excruciatingly painful, both before and after incision, and should be avoided.

In severe cases with multiple boils in the auditory meatus and elsewhere in the body, penicillin administered by intramuscular injection is of undoubted value.

If the furunculosis is recurrent the use of an autogenous vaccine should be considered. Any underlying otitis media must be treated adequately.

ACUTE DIFFUSE EXTERNAL OTITIS

In this condition there is generalized inflammation and swelling of the whole meatus. The predisposing and exciting causes are similar to those encountered in furunculosis of the meatus. In addition, it may be mentioned that diffuse external otitis is frequently associated with seborrhœic dermatitis of the scalp and not uncommonly follows the use of chemical irritants, such as methylated spirit or glycerin of phenol in greater strength than a 2½ per cent. solution. Glycerin of phenol mixed with water forms a corrosive solution and for this reason should never be used following syringing until the meatus has been mopped thoroughly dry. The local use of peroxide of hydrogen may convert a localized into a diffuse otitis externa.

Symptoms and signs.—A sensation of itching is often the patient's first complaint. The ear feels hot and pain soon develops. This is followed by swelling of the meatus, sometimes to the point of occlusion, in which event deafness may be pronounced and tinnitus and vertigo may develop. The ear is painful to touch and the pain is accentuated by movements of the jaw. The neighbouring glands are swollen and this swelling may involve even the parotid.

After a short period otorrhœa sets in. The discharge is frequently serous in character and often copious in amount. Later it becomes rosey or purulent and the meatus may be lined with a soft pultaceous cast consisting of pus cells, micro-organisms and desquamated epithelium. The discharge is never mucoid but may be fibrinous, in which event the possibility of diphtheria must not be overlooked. Systemic disturbance is more marked than in furunculosis of the meatus, and the temperature may be raised considerably.

Diagnosis.—Difficulty frequently arises in differentiating between acute diffuse otitis externa and acute mastoiditis, especially in cases in which the maximum meatal swelling is posterior and in which redness and œdema have spread over the mastoid process. In order to make a correct diagnosis it is essential to cleanse the meatus thoroughly, so that some view of the drum may be obtained through a narrow speculum. If the visible portion of the drum appears normal and the hearing is markedly improved following cleansing of the meatus, it is highly probable that the infection is confined to the outer ear. If doubt still exists as to the correct diagnosis, X-ray examination of the mastoid process may prove a deciding factor.

Treatment.—As in furunculosis, the first essential is thorough cleansing of the meatus. If this cannot be accomplished with a wool-tipped probe, the meatus should be syringed with warm boracic lotion or bicarbonate of soda solution and then carefully dried.

The second aim is to reduce swelling of the meatal walls, and this can be brought about by packing the meatus with a narrow gauze wick soaked in a solution of 10 per cent. ichthyol in glycerin. The packing is renewed daily and continued until the meatus is widely opened.

The nature of the discharge determines the measures to be adopted when the meatal swelling has been reduced. If extensive areas of superficial ulceration are present and the otorrhœa is profuse and watery, the application of Lassar's paste for a few days will do much to lessen the discharge. Ointments and creams will not adhere to the affected areas in such cases and they are better avoided. Treatment is continued by daily cleansing followed by the insertion of a wick soaked in 10 per cent. argyrol solution.

Alternative measures which have been found useful are:—

(a) The insertion of a wick soaked in the following solution, as recommended by Daggett (1942):—

Lead acetate	..	..	..	10 grains (0.65 gm.)
Burow's solution (aluminium acetate)				60 minims (3.5 c.cm.)
Peppermint water	..	..	..	1 ounce (28.4 c.cm.)

(b) Painting the affected areas with 1 per cent. gentian violet solution, followed by calamine lotion.

(c) The application of a paste containing 15 grains (1 gm.) of yellow mercuric oxide to 1 ounce (28.34 gm.) of zinc paste.

The local use of penicillin is not recommended as it frequently promotes an overgrowth of *B. pyocyaneus* in the discharge. It is suggested that this latter infection should respond to treatment with a 2 per cent. watery solution of phenoxetol.

Cases in which bacteriological examination reveals the presence of Vincent's organisms will frequently benefit from the intravenous injection of 0.3 to 0.45 gm. of neoarsphenamine, in addition to the recommended local treatment.

HÆMORRHAGIC EXTERNAL OTITIS

This condition occurs not infrequently during influenza epidemics.

The *aural symptoms* of pain, deafness and tinnitus are usually of minor degree but the patient is frequently worried by the appearance of a thin blood-stained discharge. Otoscopy reveals the presence of bluish or reddish-purple blisters in the depths of the meatus, either on the meatal walls or the tympanic membrane, or both. When a large blister obscures the upper part of the drum and resembles an inflamed and bulging Shrapnell's membrane, doubt may exist as to whether there is any underlying otitis media. While the hearing remains little impaired and the drum moves easily when examined with a Siegle's speculum the case may be treated as one of external otitis.

The condition must be differentiated from herpes zoster auricularis and aero-otitis. The former is usually associated with pyrexia and severe otalgia and is frequently accompanied by other symptoms and signs, such as marked deafness, tinnitus, nausea, vertigo and peripheral facial palsy. In the latter, a history of rapid descent from a high altitude is usually forthcoming.

Treatment.—The only local treatment required is the insufflation of a little boracic powder into the meatus.

OTOMYCOSIS

Conditions of warmth and moisture are required for the development of this affection of the auditory meatus, which is therefore much more common in tropical than in temperate climates. The infecting agent is a fungus or mould, usually *Aspergillus niger* or *flavus*, or *mucor mucedo*.

Symptoms and signs.—Symptoms may be absent. More frequently, however, the patient complains of great itching in the external meatus. If the fungus invades the underlying tissues the inflammatory reaction is accompanied by much pain. Deafness is usually slight. The meatus becomes filled with a mass of membrane which resembles a wad of wet newspaper and which re-forms rapidly after removal.

Otomycosis does not develop in cases of suppurative otitis media and any

aural discharge is always watery and never purulent. Diagnosis is confirmed by finding the typical mycelia on microscopical examination of a portion of the membrane teased out in saline.

Treatment.—Thorough removal of all debris and membrane is followed by swabbing the meatus with rectified spirit. The whole canal is then filled with a 2 per cent. solution of salicylic acid in rectified spirit. This solution is allowed to remain in the meatus for five minutes. The above sequence is repeated twice daily for seven to ten days, after which the instillation of flavine and spirit drops is continued daily for some weeks.

CHRONIC OTITIS EXTERNA

Reference has been made already to the tendency towards recurrence and chronicity exhibited by many cases of external otitis. The presence of chronic suppurative otitis media is undoubtedly the underlying factor in a large proportion of cases, but many are associated with seborrhœic dermatitis of the scalp.

Symptoms.—The skin of the outer part of the meatus becomes dry and scaly, and fissures form near the mouth of the canal. The meatus may be considerably narrowed, and epithelial debris accumulates until deafness prompts the patient to seek expert advice.

Treatment.—In the chronic seborrhœic type of case attention should be directed towards curing the scalp condition, and spirit shampoos will help in this direction. The irritation and scaliness of the meatus will respond to cleansing with spirit, followed by the application of the following cream:—

Zinc oxide	..	..	..	30 grains (2 gm.)
Calamine ointment	..	..	..	25 grains (1.6 gm.)
Thymol	..	..	..	5 grains (0.32 gm.)
Lanolin	..	..	..	q.s.
Paroleine	..	..	to	1 ounce (28.34 gm.)

Watery solutions are better avoided in the treatment of these cases.

SUMMARY

In all cases of otitis externa correct diagnosis is of the utmost importance. Errors will be few if due attention is paid to the acuity of hearing and a genuine effort is made to visualize at least a portion of the tympanic membrane.

It cannot be stressed too strongly that the essential factor in successful treatment is gentle but thorough cleansing of the meatus, particular attention being paid to the deep anterior meatal recess. Appropriate applications have been suggested for use following this meticulous toilet.

The otologist should not hesitate to enlist the help and cooperation of the dermatologist in cases which fail to respond to the simple therapeutic measures already advocated.

Reference

Daggett, W. I. (1942): *J. Laryng. Otol.*, 57, 427.

MÉNIÈRE'S DISEASE

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IN 1861 there appeared in the *Gazette Médicale de Paris* Ménière's well-known description of the triad of symptoms, vertigo, deafness and tinnitus, which has since continued to bear his name.

Ménière's ready application of the knowledge then available of labyrinthine function enabled him to recognize the labyrinth as the seat of the disorder, and the lucidity of his clinical writings has left us in little doubt of the identity of the condition which he described with "aural vertigo", as defined by Gowers and Lake early in this century and by Crowe and Wright of the present day.

Ménière also made a contribution to the pathological anatomy of aural vertigo with his well-known description of the post-mortem findings of a hæmorrhagic effusion in the labyrinth of a young girl who suffered from severe vertigo, vomiting and deafness. This observation has been the source of some confusion. Certain clinical features of this case, in particular the pyrexia and rapid exitus, have been frequently noted as quite uncharacteristic of "aural vertigo", and many have therefore doubted the relevance of Ménière's post-mortem findings to the clinical condition which he described so well. Around this doubt has grown the conception of Ménière's "syndrome", a symptom complex characterized by vertigo and deafness, and having as its cause a wide variety of pathological processes affecting any of the various elements of the Octavus system: the labyrinthine sense organs, their blood supply, the fibres of the eighth nerve or their central connexions.

Since 1938, this situation has been greatly clarified by the appearance of Hallpike and Cairn's classical description of the histological changes in the temporal bones in two typical cases of aural vertigo. The changes consisted of a highly characteristic type of distention of the endolymph system, and the findings have been verified in more than a dozen cases by a number of other observers.

Regarding the nature of the changes, hæmorrhage and inflammation were alike absent, and the distention appeared to be dependent upon some disturbance in the normal circulatory mechanism of the endolymph. This decisive demonstration of the pathological anatomy of aural vertigo, taken in conjunction with the valuable clinical analyses of Crowe (1938), and of Wright (1937), has led to a renewal of interest in the nature of the disorder. It has also stimulated the development of diagnostic procedures and of methods of clinical management. These results it has achieved above all by its establishment of the essentially otological character of the disease, and

the present is therefore an opportune moment for bringing under review, from the standpoint of the otologist, the advances which have been effected in this field during the course of the last ten years.

NORMAL AND PATHOLOGICAL ANATOMY OF THE LABYRINTH

The endolymphatic space is a closed fluid system, the endolymph being secreted by the stria vascularis, which is relatively unharmed in Ménière's disease, since its blood supply is protected against the rise of pressure.

The fluid drains into the sacculus endolymphaticus and through the sac wall into the surrounding loose connective tissue, which is absent in this disease, and it is probably absorbed by the small venous tributaries of the lateral sinus. The membranous labyrinth lies in perilymph which reaches the perilymph spaces *via* the aqueduct of the cochlear from the relatively enormous subarachnoid space. It is clear that any volume increase in the endolymph space will be met by an expansion of the thin and elastic-containing walls and by the expulsion through the helicotrema and cochlear aqueduct of a corresponding volume of perilymph. The resulting pressure change in the system as a whole will be equivalent to that following the injection of a fraction of a c.cm. of fluid into the spinal theca, that is to say, negligible. If, however, the endolymph system becomes fully dilated, then the elastic membranes everywhere are brought into contact with the rigid bony walls, except at the helicotrema, and at this point Reissner's membrane bulges into the scala tympani, the only situation allowing further expansion. Once dilatation of the endolymphatic space has become maximal, then the fluid system, from being insensitive, becomes sensitive in its response to even a minute volume increase.

ETIOLOGY

The attacks may be due to sudden asphyxia of the labyrinthine end-organs, produced by rapid rises of fluid pressure in response to relatively small volume increases in the endolymph.

On this basis certain interesting features and theories of causation of the disease can be explained. Under the abnormal conditions of fluid pressure which are indicated by the anatomical findings, there would necessarily occur a marked increase in the sensitivity of the labyrinth to any displacement of the stapes footplate, resulting either from Eustachian obstruction or from impaction of wax upon the tympanic membrane. Under normal conditions such displacements would lead to expulsion of corresponding amounts of perilymph through the aqueduct of the cochlea, with negligible rises in pressure of the fluid system as a whole. In the presence of a maximal dilatation of the endolymph system this escape of perilymph would be impossible, and a considerable rise of pressure in the endolymph system would thus occur. It is equally clear that this situation would be open

to dramatic alteration by the removal of the wax or the obstruction of the tube. Thus, although such conditions may precipitate the paroxysms so characteristic of the disease, they might be taken as indicating the existence of some primary condition within the labyrinth which has rendered it vulnerable to such abnormalities. Clinicians, generally, are coming to recognize the uncommon association of vertigo and Eustachian occlusion, and it is rare to see a positive Valsalva test present in a case of Ménière's disease.

Thus it may be supposed that there exists a chronic condition of lowered function of the affected labyrinth due to increased endolymph pressure and resulting anoxæmia of its end-organs. This condition fluctuates in a manner typical of the clinical course of the disease and may proceed during the course of the attack to complete paralysis of the affected labyrinth. Again, there would be a subacute state between the attacks with resulting chronic unsteadiness which would be much increased by sudden head movements. This could be explained on the grounds that vertigo in unilateral labyrinthine disease nearly always originates from excitation of the more active labyrinth, and that such head movements evoke a greater response from the sound labyrinth, and bring about vertigo by the relative absence of corresponding response from the affected organ.

Many observers have shown clinically that in a large proportion of these patients the signs and symptoms of cochlear and vestibular disorder present certain peculiarities in their mode of onset, in their type and degree, and also in the course which they pursue over a period of years. These data thus agree in attributing the symptoms to some specific type of labyrinthine disorder. From observations on patients before and after the division of the eighth nerve, Crowe (1938) came to the conclusion that the attacks were due to abnormalities in the normal pressure and the biochemistry of the endolymph. Both he and Wright (1937) were convinced that the symptoms were produced by a specific and common cause, although the latter arrived at the conclusion by a different method. Wright believes that a bacterial intoxication of the labyrinth which he calls "focal labyrinthitis" results. But subsequent authors have found definite evidence of sepsis in only a small number of cases of Ménière's disease, and even these were not all benefited by the eradication of the focus.

Confirmation of the labyrinthine site of origin of the symptoms by surgical means is shown by the cure of the vertigo by section of the eighth nerve and by destruction of the labyrinth.

CLINICAL FEATURES

Ménière's disease in its characteristic form presents typical sudden recurrent attacks of acute vertigo, tinnitus, and decrease in hearing. The first symptom is usually a sudden onset of violent vertigo; it may be unilateral deafness

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Ménière's disease, and in 86 per cent. it is bilateral (Cawthorne *et al.*, 1942). Usually, the hearing is most affected on the side showing the more severe vestibular lesion, indicating that the disease as a rule affects one labyrinth in advance of the other.

DIAGNOSIS

The diagnosis of the typical case is not difficult and is based largely on the patient's description of his symptoms. In most cases, examination of the drumhead reveals no abnormality; Valsalva's test indicates patent Eustachian tubes, and hearing tests show shortened bone conduction and a positive Rinne's test. Spontaneous nystagmus should be noted, and if it is present when the patient looks up an intracranial lesion may be suspected. The ability of the patient to walk in a straight line or to stand on one foot alone may be of help. Romberg's test with the patient in the usual position, and with the head inclined first to one shoulder and then to the other, helps to determine the absence of cerebellar involvement, for in labyrinthine disease the direction of falling alters with different head positions. Careful search of the central nervous system for signs of organic disease should be made, as the diagnosis is based on the absence of other causes of Ménière's syndrome, such as neuro-labyrinthitis, syphilis, tumours of the fourth ventricle, vascular lesions of the labyrinthine pathways in the brain stem, anæmia, some cardiac lesions, neurasthenia, simple biliousness and migraine. One of the first signs of cerebello-pontine angle tumour is absence of the corneal reflex. Dizziness, caused by tumours of the eighth nerve and related affections and other types of intracranial pathology, is never of the same severity and is produced or aggravated by head movements.

The caloric test.—The insensitive caloric responses of Barany have been modified by Fitzgerald and Hallpike (1942) to produce sharper results of considerable significance, and normal caloric responses occur in only 6 per cent. of cases of Ménière's disease. The labyrinth is stimulated with hot and cold water at temperatures equidistant above and below the patient's normal temperature (usually 30° and 44° C.). The finding of one or other defect in labyrinthine responses helps to confirm the presence of changes such as occur in Ménière's disease, and which are impossible of detection by the cruder methods. The occasional normal responses may be attributed to a remission in an early case producing a return to almost normal pressure. Thus the caloric test is of great value in the diagnosis of the condition and in the localization of the side of the more defective labyrinth. The side of the greatest deafness or tinnitus, the ear with perceptive loss, or the history of the attacks, help to confirm this diagnosis. These modified caloric responses have proved to be a marked advance in neuro-otology. An earlier diagnosis is possible with the more delicate findings, and, quantitatively, differences in the responses have brought to light other previously undiagnosable lesions of individual sections of the static and kinetic labyrinth.

or tinnitus. When the auditory symptoms precede the vertiginous, the interval which may elapse before the onset of vertigo sometimes extends to many years. Thus, occasionally the disease may be diagnosed and treated before the disabling vertigo appears.

Premonitory symptoms, sometimes described as aura, of many types have been noted. The onset or increase of tinnitus is probably the most frequent. Increasing deafness, a feeling of fullness in the head or nausea, at times give warning of an attack.

The attack is usually accompanied by nausea and at times by vomiting, which may be severe or even projectile and has no relation to the fullness of the stomach. Loss of consciousness may occur at times, but no convulsive movements or other evidences of epilepsy are present. Transitory loss of vision and transitory diplopia may occur without loss of consciousness, as a result of the vestibular disorder. The patient, who is pale and clammy, lies quite still—terrified in case the slightest movement should accentuate the vertigo. The duration, including time of recovery, may be minutes to many hours, although frequently the attacks last for only a few minutes. Recovery is often good and rapid; at times unsteadiness is manifest for some time afterwards. Mild persistent vertigo between the major crises may be accounted for by the continuance of minor irregularities of intra-labyrinthine pressure. During the intervals the patient is usually well. Severe headache sometimes follows or accompanies the attack and is often very similar to migraine.

Vertigo.—The predominant and the most disabling feature of the disease is the vertigo which comes on in violent apoplectiform attacks, often severe enough to throw the patient to the ground or to cause him to hold on to a nearby object. But great variability is met with in the frequency, severity and duration of the attacks in the same individual. A sensation of rotation is one of the characteristics of this vertigo, most often in the horizontal plane, although at times it may be vertical, causing the patient to fall backwards or forwards. Falling occurs either away from or towards the affected side, but in the same patient it tends always to be in the same direction. More or less constant unsteadiness with no vertiginous attacks is, occasionally, encountered. Nystagmus may accompany the attacks but does not do so on every occasion; it may be present between the attacks but little of localizing value can be gained from its direction.

Tinnitus.—This may occur as the first symptom, or as the warning of an attack. It may be described as the ringing of bells, whistling, hissing, buzzing, or throbbing. It may be paroxysmal or constant and varying in intensity and pitch, unilateral or bilateral, and is usually more pronounced in the affected ear. At first it may be cured by the removal of the peripheral organ, but soon section of the vestibular and auditory branches of the eighth nerve has no effect on it, and, like the phantom limb, the treatment is very difficult.

Deafness.—Loss of cochlear function can be observed in all cases of

convenient method would be a less severe restriction of the fluid and the salt intake, combined with a means of increasing the excretion of these substances. Until an anti-retentional diet has been tried it is impossible to predict how any given patient will respond, but it is gratifying in certain cases to discover the patient remaining symptom-free, after initial severe dietetic restriction, on a diet which causes him no inconvenience.

If severe salt restriction is to be undertaken it must be remembered that many waters contain considerable quantities of sodium chloride, and that patients tend to continue taking sodium bromide or sodium bicarbonate for "their nerves" or for their indigestion. Restriction of fluid intake to 700 c.cm. daily is as much as most patients will tolerate; two pints can usually be allowed.

The action of *histamine* in controlling the symptoms of Ménière's disease was discovered by Sheldon and Horton in 1940 while treating headaches with the drug. Atkinson (1941) ascribes the results to desensitization, but it is difficult to accept this view, as little change may be noted in the previously sensitive skin reaction of the patients sensitive to histamine after a full course of injections. The response to treatment may depend merely upon the vasodilating effect of the solution on the vessels in the region of the endolymphatic sac; nicotinic acid probably has a similar though less marked effect.

The use of histamine in the production of experimental peptic ulcer in animals may be the cause of misgivings over its use in the treatment of Ménière's disease, but a very large number of injections have excluded this drawback.

It is advisable for the patient to take a full meal before the injection, and the patient's sensitivity should be measured by the intradermal injection of 0.005 mgm. histamine acid phosphate (the solution usually prepared contains 1 mgm. per c.cm., and is diluted 1:10 for the intradermal test).

The treatment is begun by the intravenous injection of 1 mgm. of histamine base in 250 c.cm. saline, 5 per cent. dextrose, or preferably 0.8 per cent. potassium chloride over one-and-a-half hours, more or less, according to the sensitivity of the patient. The blood pressure must be watched during the operation and adrenaline should be available, although this is rarely necessary. The injection is repeated after forty-eight hours on one or more occasions. Thereafter subcutaneous or intramuscular maintenance injections of 1 mgm. per c.cm. solution of histamine base are given weekly, beginning with 5 minims (0.3 c.cm.), and advancing the dose slowly up to 20 minims (1.2 c.cm.), according to the patient's response as measured by the flushing and feeling of heat.

As in other methods of treatment, the earlier in the course of the disease the therapy is instituted the more satisfactory the results. Deafness and tinnitus both disappear in early cases.

Toxic foci which have been discovered at the clinical examination of the patient should be removed or suitably dealt with. Mygind and Dederding (1938), in addition to their measures to adjust the fluid balance, advise general supportive measures, such as outdoor graduated exercise, and proper rest.

PROGNOSIS

This is a chronic progressive disease of the labyrinth, running a very irregular course and almost always producing some permanent damage, as evidenced by the loss of hearing. Ménière's disease does not cause any obvious pathological changes in the body other than in the labyrinth, but it can, by the very violence of its symptoms, reduce sufferers to a state of chronic invalidism. Thus it requires a person of robust temperament to bear with equanimity the disturbance, both mental and physical, that forms part of the recurrent attacks. Treatment in these cases is difficult, because even if patients are relieved of their symptoms they may find difficulty in regaining self-confidence. They require constant encouragement and careful rehabilitation, particularly if subjected to operation.

In the untreated case cessation of the vertigo following complete disappearance of hearing is not a usual finding. Tinnitus is an extremely evasive symptom to treat and the patient may complain bitterly of it. As noted above, it is more likely to disappear if the disease is in its early stages when treatment is first begun. The prognosis as regards the cessation of the vertiginous attacks by one or other method of treatment is good. Ménière's disease does not often produce a high grade of deafness in both ears; when it does so, it is usually in cases in which the complaint is definitely bilateral in onset.

In assessing the results of treatment the irregularity of the disease process must be considered and the fact that spontaneous remissions are frequent.

TREATMENT

Many types of treatment have been described for Ménière's disease in the past, indicating the probability that none has been too satisfactory. Yet so many have claimed such excellent results that it is not easy to understand why treatment of the disease is still so troublesome and why so many cases seem to be failures in the hands of several physicians.

The patient is often in need of reassurance, as he believes he has a cerebral tumour or some intracranial and intractable lesion. An explanation should be given of the etiology, and he must be given to understand that gradually, but with reasonable certainty, his vertigo can be overcome. Each case must be considered as an individual problem, and the patient must understand that no immediate and dramatic results are likely.

An important factor in the patient's discomfort resulting from the violence of the symptoms is the profound mental disturbance; hence the importance of adequate sedation, at least until confidence is gained. Phenobarbitone, although non-specific in action, appears to discourage the spread of the disturbance caused by the attack to the rest of the brain. Hyoscine is perhaps more specific and more effective.

Dietetic.—In the presence of a minimal intake of salt, if the patient can tolerate such restriction, the fluid intake need not be restricted. A more

convenient method would be a less severe restriction of the fluid and the salt intake, combined with a means of increasing the excretion of these substances. Until an anti-retentional diet has been tried it is impossible to predict how any given patient will respond, but it is gratifying in certain cases to discover the patient remaining symptom-free, after initial severe dietetic restriction, on a diet which causes him no inconvenience.

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The treatment is begun by the intravenous injection of 1 mgm. of histamine base in 250 c.cm. saline, 5 per cent. dextrose, or preferably 0.8 per cent. potassium chloride over one-and-a-half hours, more or less, according to the sensitivity of the patient. The blood pressure must be watched during the operation and adrenaline should be available, although this is rarely necessary. The injection is repeated after forty-eight hours on one or more occasions. Thereafter subcutaneous or intramuscular maintenance injections of 1 mgm. per c.cm. solution of histamine base are given weekly, beginning with 5 minims (0.3 c.cm.), and advancing the dose slowly up to 20 minims (1.2 c.cm.), according to the patient's response as measured by the flushing and feeling of heat.

As in other methods of treatment, the earlier in the course of the disease the therapy is instituted the more satisfactory the results. Deafness and tinnitus both disappear in early cases.

Toxic foci which have been discovered at the clinical examination of the patient should be removed or suitably dealt with. Mygind and Dederding (1938), in addition to their measures to adjust the fluid balance, advise general supportive measures, such as outdoor graduated exercise, and proper rest.

PROGNOSIS

This is a chronic progressive disease of the labyrinth, running a very irregular course and almost always producing some permanent damage, as evidenced by the loss of hearing. Ménière's disease does not cause any obvious pathological changes in the body other than in the labyrinth, but it can, by the very violence of its symptoms, reduce sufferers to a state of chronic invalidism. Thus it requires a person of robust temperament to bear with equanimity the disturbance, both mental and physical, that forms part of the recurrent attacks. Treatment in these cases is difficult, because even if patients are relieved of their symptoms they may find difficulty in regaining self-confidence. They require constant encouragement and careful rehabilitation, particularly if subjected to operation.

In the untreated case cessation of the vertigo following complete disappearance of hearing is not a usual finding. Tinnitus is an extremely evasive symptom to treat and the patient may complain bitterly of it. As noted above, it is more likely to disappear if the disease is in its early stages when treatment is first begun. The prognosis as regards the cessation of the vertiginous attacks by one or other method of treatment is good. Ménière's disease does not often produce a high grade of deafness in both ears; when it does so, it is usually in cases in which the complaint is definitely bilateral in onset.

In assessing the results of treatment the irregularity of the disease process must be considered and the fact that spontaneous remissions are frequent.

TREATMENT

Many types of treatment have been described for Ménière's disease in the past, indicating the probability that none has been too satisfactory. Yet so many have claimed such excellent results that it is not easy to understand why treatment of the disease is still so troublesome and why so many cases seem to be failures in the hands of several physicians.

The patient is often in need of reassurance, as he believes he has a cerebral tumour or some intracranial and intractable lesion. An explanation should be given of the etiology, and he must be given to understand that gradually, but with reasonable certainty, his vertigo can be overcome. Each case must be considered as an individual problem, and the patient must understand that no immediate and dramatic results are likely.

An important factor in the patient's discomfort resulting from the violence of the symptoms is the profound mental disturbance; hence the importance of adequate sedation, at least until confidence is gained. Phenobarbitone, although non-specific in action, appears to discourage the spread of the disturbance caused by the attack to the rest of the brain. Hyoscine is perhaps more specific and more effective.

Dietetic.—In the presence of a minimal intake of salt, if the patient can tolerate such restriction, the fluid intake need not be restricted. A more

HEARING AIDS FOR THE DEAF

BY A. W. G. EWING, M.A., PH.D.

Director, Department of Education of the Deaf, University of Manchester.

GREAT advances in hearing aid technique have been made since 1939. There has been progress in the design of aids, in determining their performance and the help that they give to individual patients. Complementary to these advances have been large-scale systematic and successful experiments in training patients to use hearing aids with understanding and skill. Some of these developments, especially in the United States, have been directly associated with phases of the war effort, others are the outcome of long-term policies now brought to fruition in spite of the war.

There can be no doubt that under every heading but one the immediate situation for users of hearing aids is more favourable in the U.S.A. than in any other country because of its vast resources that were not so exclusively concentrated for purely war-like purposes as those of Britain and countries of Western Europe. The most recent and efficient types of aid make use of components, for instance, miniature bakelite cases, the manufacture of which involves many costly tools and processes, since the highest degree of accuracy is essential. This has changed the economics of production. Initial expenses tend to be very high and a particular model can only be retailed to the public at a moderate price if the makers are sure of a sale running into thousands.

Inevitably there has also come about a need to employ a very highly qualified scientific staff with elaborate equipment to decide upon the adoption of new components or alterations to circuit, and to assess the value to deaf patients of consequent changes in performance and output. It is possible that these economic factors alone would justify the decision of H.M. Government recently announced in Parliament to have a hearing aid of approved design mass-produced through the Ministry of Supply. In this respect Britain stands alone, as also in the decision that aids of this official type shall in 1948 be provided free to insured patients as part of the new Health Service. In the U.S.A., as in this country, hearing aids have been available without cost to deafened Service personnel, but not to civilians, and the instruments used have been bought from commercial firms by the departments concerned.

I was privileged to spend six months of 1946 visiting centres of work for the deaf in numerous parts of the U.S.A. and Canada. The references that follow to developments in those countries are based on opportunities of intimate discussion with many leading authorities in otology, research, administration, and with those responsible for aural rehabilitation, the education and welfare of the deaf and the manufacture of aids. It was intensely stimulating and helpful to compare the knowledge most generously

Operative.—Finally, as it is sometimes necessary to destroy an eye hopelessly disorganized by inflammation or disease and so of no further use, so is it desirable to destroy a diseased labyrinth which, no longer useful for hearing, is producing distressing vertigo. All workers agree that surgical intervention should be reserved for patients who do not respond to medical therapy. Probably one-tenth or rather more of the patients in all the series reported have needed operative treatment; the worker in dangerous occupations more often than the sedentary or office worker.

Section of the eighth nerve, long in favour, was based on the erroneous belief that an irritative lesion of the eighth nerve itself was the causal factor, but knowledge of the exact anatomy of the condition has caused the operation to be supplanted by the safer and more easily performed destruction of the labyrinth. Theoretically, section of the vestibular division alone is an excellent approach to the problem; but the disease may cause such distortion of hearing on the affected side that any but the softest of sounds are distressing. Thus patients often prefer to be without the remainder of the hearing on the affected side, as they are unable to listen to loud sounds, such as the wireless, without discomfort. In many cases the attacks continue without the vertigo, and deafness and tinnitus increase so that soon the hearing becomes valueless, even if it were not so beforehand, and post-operative visual disturbances, which are severe and permanent in bilateral cases, occur when the patient is in motion.

After either section of the eighth nerve or destruction of the labyrinth, unless that labyrinth is inactive at the time of operation and the other side has taken over the function (complete compensation), there will be severe vertigo for some days, followed by directional preponderance of the caloric responses to the opposite side.

The ability to reorientate himself after operation varies with the type of patient and the severity of the reaction. Considerable help may be had from exercises which encourage the patient to move the head and eyes freely in all directions (Cawthorne, 1943).

I wish to acknowledge my indebtedness to the Director and Staff of the Otological Research Unit.

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given from these sources with that acquired through prolonged study of the same problems in their British setting.

DESIGN AND CONSTRUCTION

The midget valve apparatus.—An outstanding development under this heading is the reduction in size and weight of aids of midget valve or, as Americans say, vacuum tube type. These aids can now be worn without difficulty by women, as well as by men, with such a degree of comfort that they can be forgotten. A considerable amount of bodily movement is practicable without displacement of the instrument. Even children can wear these aids with success. Because of their high standard of performance and because, apart from the receiver or ear-piece, the whole instrument can be worn under the dress or suit, these aids are superseding other types.

All four of the essential components—transmitter, amplifier unit, batteries and ear-piece—have undergone improvement. Incorporation of the transmitter in the amplifier unit seems to have become general practice. This makes for lightness and simplicity as compared with the plan of attaching a separate microphone by an outside flex. It is understood that piezo-crystals have been developed which are able to withstand the high levels of humidity and temperature that result when they are worn on the body in very hot climates. Midget valves of smaller size have been introduced, some flat in shape. There has been a corresponding reduction in the space needed for other parts of the amplifier circuit. Plastics are employed for the small cases required. One excellent American model is equipped with a plastic chassis, small and light but of great strength, fitted with grooves adapted in size and shape to receive the various components of the amplifier unit.

Some of the best aids are of *mono-pac construction*, i.e., their batteries are included with the transmitter and valve amplifier in a single case. For other aids outside batteries still need to be worn. With most makes the suitability of each of these types for particular patients depends, in the first place, upon the degree of deafness and therefore upon the voltage and capacity of the high-tension or B battery required. The needs of patients whose hearing loss for sound of frequencies 512 to 2048 double vibrations per second is not greater than 60 decibels are usually met by the provision of a B battery of 33 volts or less. This can be of leaf type constructed in layers, and therefore of very small dimensions. It is still normal practice to make the larger 45 volt batteries with midget can cells—miniature versions of the cells in zinc cases long familiar to users of electric torches and cycle lamps. The most recent advances in valve construction, however, are leading to more economical current consumption. Without reduction of output from the amplifier it has become possible to employ 33 volt batteries to give an output for which, only a year or two ago, 45 volts were needed. The size and number of low-tension or A batteries is being diminished for the same reason. An improvement most welcome to the patient has been the evolution

of midget telephone receivers, fitted snugly into the external auditory canal with moulded inserts of plastic.

In the U.S.A. or Canada no patient now uses an individual hearing aid with a telephone receiver of disc type. Without exception, all patients who have been referred to the Research Unit at Manchester University, having once seen or used the moulded insert type of receiver, express the strongest possible preference for it. The merit of the disc receiver, whether magnetic, moving-coil or crystal, has been its capacity to deliver loud sound to the ear with a relatively low factor of distortion. Its disadvantages were three; its unsightliness, the discomfort resulting from continued mechanical pressure on the auricle (slight swellings of the auricle and skin irritations have sometimes been noted), and annoyance to the patient and to others if the head-band is adjusted so imperfectly as to allow a leakage of sound. *The modern moulded insert ear-piece* needs no head-band or wire loop to attach it. If correctly fitted it can be worn all day and every day without causing discomfort of any kind or being displaced by movement of the head or jaw. The most favoured material is lucite, which is transparent, colourless and inconspicuous. Individual variations in the size and shape of the external ear are numerous and significant. There are often dissimilarities between the ears of a single patient. It is therefore essential for ear-pieces to fit with great accuracy to ensure purity of reproduction, as well as comfort, and to avoid the risk of whistling or acoustic feed-back when the aid is used at or near full volume. The insert should therefore be "made to measure" by trained technicians.

Lederer and Hardy (1946), in a comprehensive report on the work of the Speech and Hearing Rehabilitation Unit, United States Naval Hospital, Philadelphia, state that "the old technique of pouring an ear impression with a plaster mix, awkward, uncertain and finicky as it is, is thoroughly outmoded". They have developed a method of fabricating ear moulds from a methylmethacrylate resin. It has been found simple and expeditious. Four trained technicians can make as many as thirty ear moulds within a twenty-four hour period. There are three main processes—the first impression, a cast from this, then the plastic mould made from the cast. During the finishing process a canal to conduct sound waves is drilled out with extreme accuracy. Plastic or rubber inserts of standard sizes are sometimes used. They were tried in the Rehabilitation Unit at Philadelphia but were found unsatisfactory. Lederer and Hardy say that they may lessen the efficiency of an aid by as much as 20 decibels.

When completed the plastic mould is fitted with a metal socket to hold a press-stud projection from the midget receiver. It is claimed for the crystal type that it ensures particularly good reproduction of sound of the high frequencies important to the recognition of the consonants in speech. Magnetic receivers can be designed to give increased magnification to sound of about the same level of pitch. Both types of receiver are capable of de-

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livering sound to the ear at high levels of loudness, in cases in which this is required.

Bone conduction receivers are available as alternative fittings for use with a number of valve aids. Their use appears to be on the decline. This seems to be due partly to the increased efficiency of midget air-conduction receivers. There is also the factor that good reproduction by bone depends upon the application of the receiver to the mastoid with a considerable degree of pressure, and that a head-band is needed to maintain this. Bone-conduction receivers are often recommended for patients suffering from chronic otorrhœa.

Amongst other features in which technical progress has been made are the production of amplifier cases, receiver caps and flexes or cords in a variety of attractive colours. Lederer and Hardy report that *plastic treated cord* is less productive of cord noise as well as more durable than flex sleeved in cotton, but that the plastic cords at present on the market are less durable than they should be. Experiments continue in the design of different types of harness to enable aids to be worn with equal efficiency and comfort by men, women or children, and there are firms that specialize in this type of equipment. To have the transmitter-amplifier unit in a pocket of silk reduces somewhat the noise that is liable to arise from friction through contact with clothing during the wearer's movements.

Besides the usual volume control a number of current hearing aids are fitted with devices designed to limit the total volume of sound falling on the ear without impairing the clarity with which speech is reproduced. This subject is best discussed in relation to the prescription of aids.

TESTING OF HEARING AND THE FITTING OF AIDS

It is important that recent contributions to knowledge under this heading should be made known as quickly and widely as possible. Earlier conceptions of the principles involved in prescribing aids were often based too exclusively upon the theory that losses of auditory acuity for sound of specific bands of pitch could be compensated by proportionate magnification in these ranges of frequency. It was sometimes thought, for instance, that patients with severe deafness to tones upwards of 1024 v.d. would benefit most from aids designed to give much greater amplification for upper than for lower tones. Capacity to hear sound of high pitch is necessary to the recognition of many of the consonants in speech. Consonants occur approximately twice as often as vowels and contribute relatively more to intelligibility. From this conception arose the theory that hearing aids could be "made to measure". Determination with a pure-tone audiometer of the individual patient's losses of acuity at discrete levels of frequency would indicate to the designer his particular needs as regards amplification and, so the theory ran, the output of the aid would be adjusted to give precisely the type of reproduction desired. Research by many workers shows that this

view needs to be modified considerably and that there are other considerations of greater importance.

The capacity of the modern valve-aid to reproduce sound very loudly without distortion due to overloading has made it helpful even to severely deaf patients. L. A. Watson, in 1944, and others have reported that patients with hearing loss of 95 decibels in the frequency range 1024 to 2048 v.d. have been enabled to follow normal speech at a distance of several feet with sufficient accuracy to make direct conversation possible. Lederer, Harkins, Hardy and Thompson state that a majority of U.S. naval personnel referred to the Aural Rehabilitation Unit (1946) as cases of chronic progressive deafness had hearing losses greater than 70 decibels, with marked reduction of bone conduction, and that they were beyond the scope of the fenestration operation, yet only 6 per cent. of all patients have proved incapable of being trained to use aids with success. Few patients with a hearing loss of 70 decibels at 1024 v.d. can hear a moderately loud voice at 4 feet, and a loss of 95 decibels at that level of pitch usually entails inability to hear more than a faint inarticulate sound when words are shouted directly into the ear.

The most serious factor in many cases of severe deafness, and in some cases less severe, is inability to tolerate very loud sound. Comparative measurements have been made using both pure tones and speech sounds, to determine (a) the level of loudness at which a stimulus is just audible and (b) the level at which it becomes intolerable. Many patients with a diagnosis of lesions of the internal ear or auditory nerve, accompanied by marked loss of acuity to sound by bone conduction, are found intolerant to variations in loudness that cause no inconvenience to normal listeners. The term "recruitment" has been given to this phenomenon. In some cases the range of usable hearing within the two limits is as small as 10 decibels. This is much less than the difference of 30 to 35 decibels between the maximum loudness reached by vowel sounds, such as AH (bark) or AW (fall) in average mf conversation and that of the weakest unvoiced consonant TH (thin). In an extreme instance of recruitment an aid adjusted to enable the patient to hear weak consonants is likely to reproduce vowels so loudly (as it seems to him) as to be intolerable. This problem is further complicated by the wide variations in speech power exhibited by quiet and loud speakers and by the noisy conditions in which so many people live and work. The capacity of some patients to tolerate sound of unaccustomed loudness can be increased by training. Lack of tolerance is not necessarily a phenomenon of subjective experience. At Manchester, as in other centres, investigation has revealed instances in which musical tones, if moderate in loudness, seem normal to the listening patient, but changed in pitch and distorted if their loudness is increased. Effective control of the loudness of sound by mechanical and automatic means is the obvious radical treatment. Great strides have been made towards this end. During the recent

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verbal material is carefully prepared to introduce the vowels and consonants with the frequency with which they occur normally in an average passage of similar length in English, or whatever language is used. It is necessary for the vocabulary to be familiar to the patients and if sentences are used they should be simple. Single words, which may be preceded by a formal introductory phrase to facilitate naturalness, e.g. "Can you hear?", constitute a more searching form of test than lists of sentences, in which an inevitable element of content contributes to recognition. Meaningless syllables, such as "thok" "pel" are the most difficult material of all, but their use only leads to reliable and regular scoring if listeners are given considerable experience and practice.

To control variations in the loudness, pitch, duration and pronunciation of word and sentence lists, gramophone recordings of selected speakers are sometimes used. Reproduced from a loud-speaker they can be employed to test a patient's capacity to hear speech, either through an aid or with the unaided ear. "Live" speech, relayed through an amplifier system which provides a mechanical means of regulating loudness, and if necessary quality also, has been proved very effective by many workers. By these methods an extremely valuable system of speech audiometry has been established. On a conservative view it may be depended upon to indicate clearly and reliably a large and appreciable difference in the accuracy with which speech is heard by a particular listener or group of listeners in any two controlled sets of conditions which it is desired to compare.

Investigation of acuity with a reliable discrete frequency or pure-tone audiometer is especially valuable for the elucidation of those cases of hearing loss in which there is total or virtually total deafness to appreciable bands of pitch within the speech range. The relative importance of the four octave bands involved has been clearly indicated in the provisional chart published under the authority of the American Council of Physical Therapy (1942). The percentage contribution of each of these octaves to the accuracy with which speech is heard are given as:—

<i>Octave</i>						<i>Percentage</i>
1024 - 2048	..	..	..	..	..	35
512 - 1024	..	..	..	..	..	30
2048 - 4096	..	..	..	..	..	20
256 - 512	..	..	..	..	..	15
						<hr/>
						100
						<hr/>

HEARING AIDS AND AURAL REHABILITATION

In the aural rehabilitation units, established by the U.S. Government for deafened army, navy and air force personnel, treatment and training were given to some 13,000 patients. Of 3,000 who passed through the Naval

war, basic research was done on problems of hearing and deafness, in the Psycho-Acoustic Laboratory at Harvard and at the Central Institute for the Deaf, St. Louis. Reports issued from Harvard on the results of these investigations have described the gain to deaf patients from two methods of control. These are (a) clipping or the elimination of peaks of loudest sound (Gross and Licklider, 1946) and (b) compression or the bringing of both loud and quiet sounds within predetermined limits.

Certain aids manufactured by commercial firms incorporate devices that may be used to limit the total volume of sound energy falling on the ear without unduly diminishing the clarity with which speech is reproduced. These devices, whether described as discriminators or tone controls, are often very useful, but most patients find that they need also to make adjustments of their volume control to meet variations in voices, in extraneous noise, or in the acoustics of different rooms.

For the war-time investigations at Harvard, master hearing aids were designed and constructed. The drastic limitations of size and weight inevitable to wearable or portable aids were ignored. The equipment was capable of reproducing sound at levels of loudness so high as to be intolerable to listeners with normal hearing. Controls were available by means of which sound within specified bands of pitch could be increased or diminished in loudness, or eliminated from the version reproduced to the listener. Hallowell Davis described the results in a paper given at the Annual Summer Meeting of the American Otological Society in 1946*. High fidelity, or accurate reproduction and uniform amplification of all speech sound, irrespective of frequency, was found more beneficial to the deaf patients who took part in the investigation than selective amplification or attempts to boost up the loudness of bands of pitch in which the deafness was greatest. In this country similar equipment, designed and constructed in the Post Office Laboratories for the Medical Research Council, has been extensively used for tests of deaf patients in London and Manchester. The results are as yet unpublished.

Wearable or portable instruments cannot provide as much sound energy as this laboratory equipment, nor is it as uniformly distributed over the range of pitch involved in speech. There tend to be differences between instruments of the same make that prove to have a significance which is appreciable to individual patients. Therefore when several types of aid are available and can be shown by tests in the laboratory to be equally efficient, reliable and economical in performance, it is usually considered best to let every patient make trials with each. These trials include tests under acoustically controlled conditions, and experimental use of aids by patients in the circumstances of their daily life. In the clinic or laboratory the patient is asked to repeat what he hears of lists of sentences or words. This

*Owing to postal delays, the published reports of this meeting, at which I was present, have not yet come to hand.—A.W.G.E.

(1946) reports an experiment which proved that, through training in which individual hearing aids were used for a period of three years, pupils of the New Jersey School for the Deaf with average losses for frequencies 512, 1024 and 2048 in the better ear up to 80 decibels have been educated predominantly through hearing, and that children with losses varying from 90 to 94 decibels constitute a border-line group. Barrett (1946) states that in Chicago during session 1944-45 there were 141 children enrolled in hearing aid classes in one of the large centres, of whom one-third were profoundly deaf or deafened, the remainder hard-of-hearing. In the same city, including both elementary and high schools, the special centres for children with defective hearing are equipped with 45 electrical multiple group aids and 486 head phones. Individual aids are worn by 80 children but "it was necessary to teach these pupils to use their new instruments".

Montague (1946) quotes numbers on the results of an experiment lasting four years with a class of seven severely deaf children (hearing losses 80 to 120 decibels) at the Clarke School for the Deaf, Massachusetts. At the end these children scored highest of a group of over 40 children in tests of speech, language, lipreading and general educational subjects.

At the Mount Airy School for the Deaf the number of group aids was increased from one in 1931 to twenty-two in 1941, used by 40 per cent. of the pupils in the school. This number has since been increased. At this school, in 1942, systematic tests, in which gramophone recordings of the pupils' speech were made, showed that those who had been taught with aids from the time of entrance had superior speech to those who had had one, two or three years of instruction before using an aid.

An account has been published elsewhere of results obtained at Manchester over a long period, in the education of severely and partially deaf boys and girls with the help of group aids designed by Littler (Ewing and Ewing, 1938.) More recent evidence has become available in the film "Education of the Deaf" sponsored by the British Council, with its photographs and sound-track of a choir of 40 pupils of the Royal Schools for the Deaf, Manchester. Investigation of the audiograms shows that the hearing losses in 18 cases exceeded an average loss of 55 decibels (Ewing and Reed, 1947). Successful training of this choir is reported by their headmaster to be to a very large extent a result of auricular training with group aids.

In this country the production of group aids virtually ceased during the war years, and in many cases it was impossible to maintain aids in use owing to the evacuation of schools or the non-availability of technicians and spare parts. This affords the opportunity, during the present years of reconstruction, to formulate a new policy for the adequate supply and more effective use of hearing aids by school children. This policy needs to be comprehensive. It calls for the close, active and informed cooperation of the medical and health services with educationists, psychologists and parents. The Ministry of Education, in a pamphlet (1946), outlines the

Unit at Philadelphia over 2,200 were supplied with aids, and only 5 per cent. of these were found to have been subsequently discarded.

The success of this great effort seems incontrovertible proof that hearing aids can be of inestimable benefit to deafened adults. Two aspects of these organizations are emphasized, however, by those responsible. First, that the task of aural rehabilitation requires the closest possible cooperation between medical and non-medical services (*U.S. Naval Medical Bulletin*, 1946). Second, that the low percentage of aids subsequently discarded was due to the operation of a system of scientific testing to ensure the suitability of particular instruments for particular patients and a planned programme of training in their use in combination with lipreading. The duration of the course of intensive training at the naval unit is from four to six weeks. Practice in the use of aids is graduated in difficulty. In the first week patients listen through a group aid in a quiet room. This usually results in improvement in tolerance for noise and gives familiarity in listening to amplified sound. In later stages, while using individual aids in a variety of conditions, patients are given further specific training and tests and are urged to express their likes and dislikes. The course is preceded by a comprehensive investigation of general health as well as by examination of ears, nose and throat, with subsequent treatment when this is indicated. To quote Lederer (*U.S. Nav. Med. Bull.*, 1946):—

"The goal is the restitution of the total person. A man is taught speech reading, fitted with a hearing aid and trained to use it, not merely so that he may again be able to perform certain military duties with efficiency or so that he may get some sort of job after his discharge. He is taught how to live a complete, full, economically and socially sufficient life in a normal hearing world. Moreover, and equally important, he is educated in the problem of his handicap and taught how to meet those problems intelligently."

In the period under review the staff of the naval unit included otologists, psychologists, educationists responsible for lipreading, speech therapy, auditory training and audiometry, occupational therapists, with specialists in educational training and instructors in physical training. The social and economic value of this unit and those like it, established by the U.S. Army, is beyond dispute. The need for similar organizations adapted to civilian conditions in peace time is obvious to all who are familiar with the handicap of deafness, which at present so often cripples a patient's occupational, social and mental life.

DEFECTS OF HEARING IN CHILDHOOD

The inventor of the telephone, Alexander Graham Bell, whose inspiration, knowledge and teaching did so much to promote the teaching of speech to deaf children in America, foresaw the day when hearing aids would help many of them. It is now known that aids can be used with success by many children whose deafness is so severe and early of onset that they are dumb when first admitted to school, as well as by the partially deaf. Myklebust

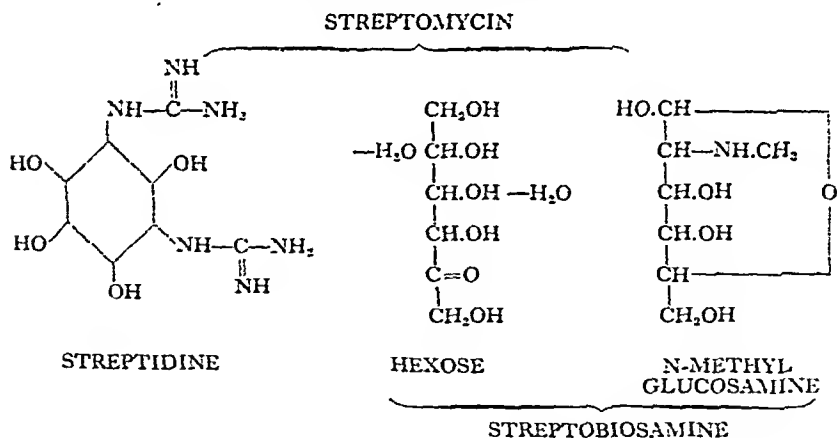
STREPTOMYCIN

By WILLIAM A. R. THOMSON, M.D.

As Sir Howard Florey has described so vividly in his Lister Memorial Lecture (1945), the story of the antibiotics dates back at least to the days of Pasteur. Of all the antibiotics few have aroused greater interest than streptomycin. This substance, which is the product of a soil organism—*Actinomyces griseus*—was isolated by Waksman and his colleagues in 1944. *Actinomyces griseus* (fig. 1, p. 140) is one of a group of organisms which was shown to produce antibiotics by Lieske in 1921. It was only two years before their isolation of streptomycin that Waksman and his colleagues (1942) had isolated from this same group of actinomycetes, streptothricin, whilst in the same year, in this country, Gardner and Chain (1942) had isolated the substance which they named proactinomycin, which was found to have a bacteriostatic effect on a considerable range of pyogenic organisms.

PROPERTIES OF STREPTOMYCIN

Streptomycin is a water-soluble base consisting of streptidine and streptobiosamine, which is dispensed either as the sulphate or as the hydrochloride.



It is insoluble in the usual organic solvents. Both salts are very soluble in distilled water or isotonic solution of sodium chloride.

Its great advantage from the clinical point of view is that it acts upon a large range of gram-negative organisms which are penicillin-resistant (see table 1 and fig. 2, pp. 141 and 142). These organisms include:—

Escherichia coli
Eberthella typhosa
Salmonella paratyphi
Salmonella enteritidis

organization and methods for ascertainment and treatment required to fulfil the provisions of the Education Act of 1944. An obligation is now laid upon Local Education Authorities to provide free special educational treatment to handicapped children from the age of two years, if the parents desire it and if the medical officer confirms the need. Measures of immediate urgency are the provision of full opportunities of aural rehabilitation for children who are partially deaf, to enable them to follow a normal curriculum, the establishment of centres for the guidance of parents of deaf and partially deaf children to enable them to give suitable home training before and after the children's admission to school, and the introduction of modern wearable aids into existing schools for the deaf.

In the research unit at Manchester University over 300 individual examinations of children under five years of age, referred from hospitals or by otologists, pædiatricians, psychiatrists or general practitioners, are made annually. The results of home training by parents under expert guidance, given to children under two years of age, often surpass all expectations. Many of the children would, not long ago, have been classified as deaf mutes. In a number of cases auricular training, although often given in the first place without an aid, has revealed possibilities of the development of speech on a predominantly hearing basis, although little response to sound could be obtained at the first tests.

In conclusion, it cannot be too strongly emphasized that as with the deafened adult, so with the child, the fitting of a hearing aid is only part, although often an essential part, of the measures that are needed to develop a complete, well-adjusted, educated personality.

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streptomycin in infections of the genito-urinary tract. Finland *et al.* (1946), for instance, found that in some of their patients treated in this way the specimens of urine were definitely acid, and they refer to three patients under observation in whom adequate alkalinization of the urine had resulted in rapid and complete elimination of the organisms from the urine after treatment with streptomycin had been initiated.

TABLE 1
A COMPARISON OF STREPTOMYCIN AND PENICILLIN ACTIVITIES
IN VITRO

Organism	Gram staining	Dilution of streptomycin base giving complete inhibition	Dilution of penicillin giving complete inhibition
<i>B. coli</i> (assay strain)	—VE	1 in 1,000,000	1 in 8,000
<i>B. coli</i> (no. 11 strain)	—VE	" " 666,000	" " 28,000
<i>P. aeruginosa</i>	—VE	" " 133,000	" " 11,000
<i>E. typhosa</i>	—VE	" " 250,000	" " 28,000
<i>B. dysenteriae</i> (Shiga)	—VE	" " 500,000	" " 111,000
<i>B. dysenteriae</i> (Flexner)	—VE	" " 333,000	" " 222,000
<i>Salmonella</i>	—VE	" " 333,000	" " 111,000
<i>B. proteus</i>	—VE	" " 184,000	" " 416,000
<i>Streptococcus pyogenes</i>	+VE	" " 200,000	" " 416,000
<i>B. subtilis</i>	+VE	" " 250,000	" " 833,000
<i>Staph. citreus</i>	+VE	" " 1,660,000	" " 83,300,000
<i>Staph. aureus</i>	+VE	" " 1,000,000	" " 83,300,000
<i>D. pneumoniae</i>	+VE	" " 133,000	" " 22,200,000
<i>M. tuberculosis</i> (H.418 strain)	+VE	" " 200,000	little activity

The dilutions are given as parts by weight of pure substance

Another important practical point concerning streptomycin is the tendency for organisms to develop resistance. Many reports have now appeared, based upon experimental and clinical work, showing that such a resistance is liable to occur, particularly if inadequate dosage has been given in the early stages of treatment. Edwards and Kirk (1946), for instance, reported a fatal case of septicæmia due to *Aerobacter cloacæ* in which an increase of over 1000 times the original resistance of the organism to streptomycin was observed during the course of thirty days of continuous treatment. Buggs and his co-workers (1946) found the same tendency in 212 strains of various organisms from patients obtained before and during treatment with streptomycin. In the experimental animal, Miller and Bohnhoff (1946) found that repeated cultivation of gonococci and meningococci demonstrated that within four to six transfers, growth was occurring on concentrations of 75,000 units of streptomycin per c.cm., where the original resistance was found to be between 1 and 40 units per c.cm.

Shigella dysenteriae
Proteus vulgaris
Aerobacter aerogenes
Pseudomonas aeruginosa (*Bacillus pyocyaneus*)
Klebsiella pneumoniae
Haemophilus influenzae
Haemophilus pertussis
Staphylococcus aureus (some strains)
Mycobacterium tuberculosis
Brucella melitensis
Brucella abortus
Brucella suis
Pasteurella tularensis
Pasteurella pestis

There is, however, considerable variation in the sensitivity of these organisms, and there is evidence to show that some strains within a given species demonstrate variation in their susceptibility to streptomycin.

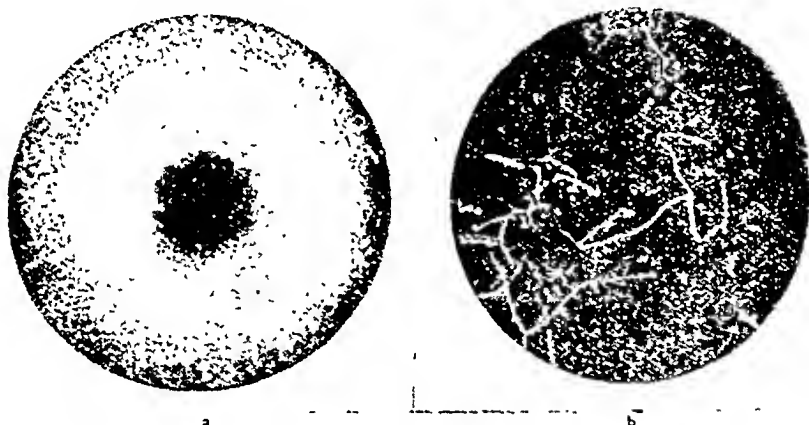


FIG. 1.—*Actinomyces griseus*: (a) $\times 200$; (b) $\times 1800$.

Other important properties from the clinical point of view are that in the presence of blood or serum, resistance of organisms to streptomycin may be increased even up to eight times, whilst an increase in the acidity of the medium also detracts from the clinical efficiency of streptomycin. This is in contrast to penicillin, the antibacterial activity of which is enhanced by an increase in the acidity of the medium. As tissue damage is accompanied by an increase in acid, this suggests that a concentration of streptomycin which is effective in the blood may be inadequate to destroy bacteria in local lesions (Abraham and Duthie, 1946). *In vitro* it has been shown that the bacteriostatic activity of streptomycin for *B. coli* is reduced in the presence of cysteine, sodium hydrosulphite, sodium formate and sodium thiosulphate (Bondi *et al.*, 1946). This, as well as the effect of alteration in pH, may be a factor in the failures which sometimes occur with the use of

streptomycin in infections of the genito-urinary tract. Finland *et al.* (1946), for instance, found that in some of their patients treated in this way the specimens of urine were definitely acid, and they refer to three patients under observation in whom adequate alkalization of the urine had resulted in rapid and complete elimination of the organisms from the urine after treatment with streptomycin had been initiated.

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One final point may be mentioned here, namely, the observation of Welch *et al.* (1946), that in certain concentrations streptomycin may actually have a stimulating effect upon the growth of bacteria.

Following the parenteral administration of streptomycin, it is widely distributed throughout the body fluids: blood, urine, ascitic fluid, pleural fluid, aqueous humor, vitreous humor, amniotic fluid and bile. Only small amounts appear normally in the cerebrospinal fluid, but there is evidence to

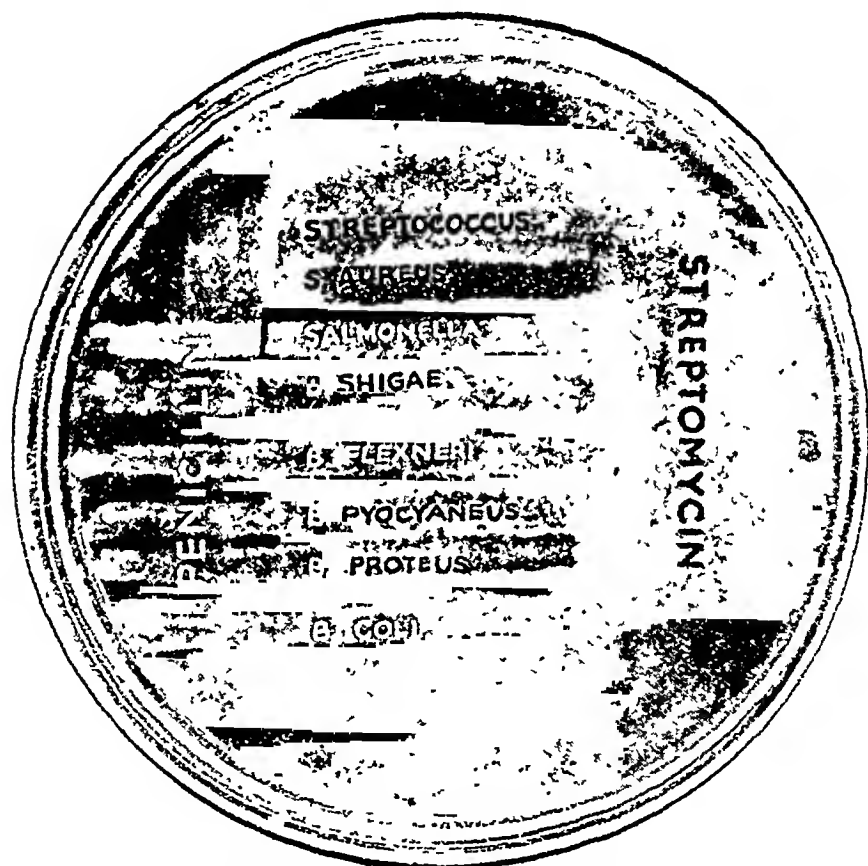


FIG. 2.—Ditch plate illustrating the *in vitro* activity of streptomycin in comparison with penicillin.

suggest that this amount is considerably increased in meningitis. Thus in one case of *Hæmophilus influenzae* meningitis, Zintel and his colleagues (1945) found a concentration of 25 units per c.cm. in the cerebrospinal fluid. Streptomycin is excreted principally in the urine.

An interesting feature of streptomycin, and one which may have important clinical aspects, is that, when given orally, very little absorption,

if any, occurs from the gastro-intestinal tract, but it is retained in an active form in the intestine for a considerable period. Excretion takes place in these circumstances only in the fæces.

TOXICITY

Streptomycin is relatively non-toxic in therapeutic doses, and even with prolonged dosage relatively few toxic reactions of serious import have been reported. These reactions may be due either to streptomycin itself or to impurities, and into this latter group fall the histamine-like reactions which have been observed. Two fatalities from histamine-like reactions have been recorded.

In their series of 1000 cases, Keefer and his associates (1946) encountered the following reactions:—

Local reactions in 28 patients
Histamine-like effects in 100 patients
Sensitization reactions in 98 patients
Pyrogenic reactions in 49 patients
Neurological disturbances in 52 patients
Miscellaneous in 5 patients

Perhaps one of the most serious toxic reactions is the effect upon the eighth nerve apparatus. In a careful analysis of 23 cases in which such a reaction was observed, Brown and Hinshaw (1946) conclude that the toxic process involves the mechanism of the peripheral portion of the eighth nerve. Symptoms of involvement of the eighth nerve are no contraindication to the administration of streptomycin in serious types of tuberculosis, since compensation for loss of labyrinthine function tends to occur. There is also some evidence that in the experimental animal the parenteral administration of streptomycin produces fatty metamorphosis of the kidney and liver parenchyma, but in a series of nine patients, Hettig and Adcock (1946) found no impairment of renal or liver function studied by means of bromosulphate, cephalin cholesterol flocculation and urea clearance tests. In two of their patients who died, post-mortem examination revealed no evidence of a renal or liver lesion that could be attributed to the action of streptomycin.

SPECIFICATION AND ASSAY OF STREPTOMYCIN

The following are the specifications introduced by the Food and Drug Administration of the Federal Security Agency on July 15, 1946:—

- (1) The minimum potency of commercial streptomycin shall represent not less than the equivalent of 300 microgrammes of streptomycin base per milligramme of dry powder. The potency of crystalline streptomycin base has been established at 1,000 microgrammes per mgm.
- (2) It is sterile.
- (3) It is non-pyrogenic.
- (4) It is non-toxic.
- (5) Its moisture content is not more than 3 per cent.

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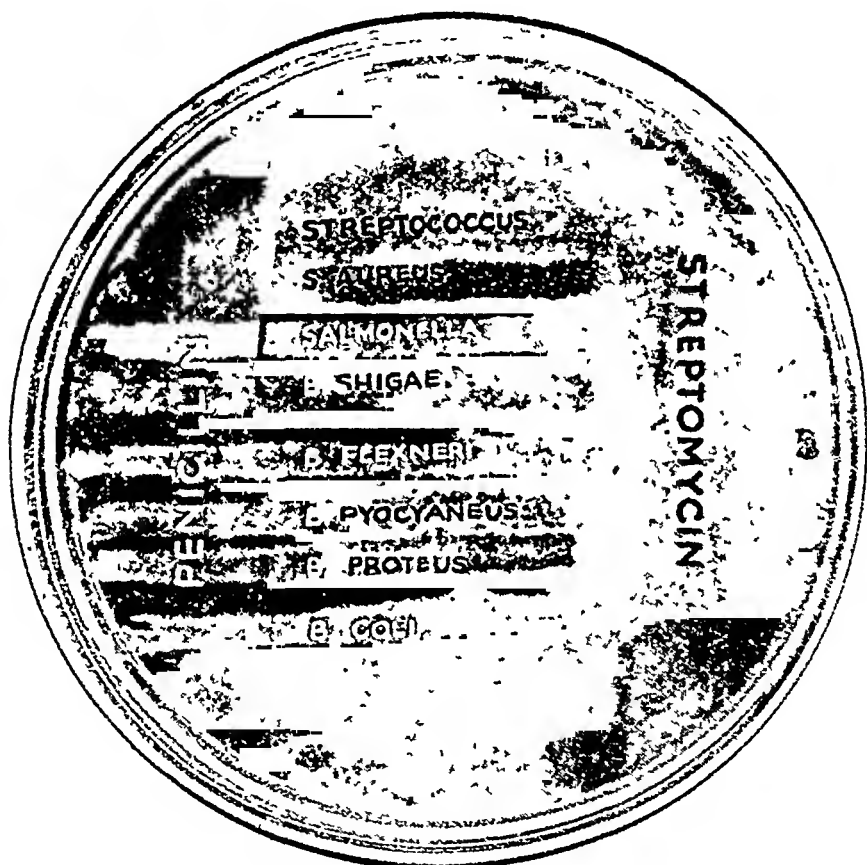


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laboratory tests, but, as has already been pointed out, this is merely a guide to dosage in man. The recommendation has been made that the aim should be to maintain a concentration of streptomycin in the blood four to eight times that necessary to inhibit completely the organisms *in vitro*. The usual maximum tolerated daily dose by the intramuscular route is 4 to 6 gm., concentrations of 100 to 175 mgm. per c.cm. being used. For intrathecal injection 25 to 100 mgm., dissolved in 5 to 10 c.cm. of normal saline, every twenty-four hours, is usually adequate, whilst in the case of oral administration 2 to 3 gm. daily are generally necessary. For inhalation, concentrations of 50 mgm. per c.cm. may be inhaled to a total amount of 500 mgm. in twenty-four hours.

CLINICAL INDICATIONS

These can be summarized briefly in the following conclusions taken from the comprehensive report recently issued in the United States of 1000 cases treated with streptomycin (Keefer *et al.*, 1946).

"Streptomycin is the best chemotherapeutic agent available for the treatment of tularæmia.

"Extremely favourable results have been obtained in the treatment of *Hemophilus influenzae* meningitis.

"Streptomycin should be used in all cases of bacteriæmia due to gram-negative bacilli.

"In cases of urinary tract infections, it is plain that streptomycin is effective in many cases in which the sulphonamides have failed.

"The results in the treatment of typhoid, salmonella infections and brucellosis have been disappointing.

"Peritonitis due to perforated lesions in the gastro-intestinal tract needs additional study.

"All patients with meningitis due to gram-negative bacilli should be treated with streptomycin.

"Diseases of the pulmonary tract due to gram-negative micro-organisms need to be studied much more extensively with systemic as well as local treatment (inhalation).

"Friedlander's bacillus and *H. influenzae* pneumonia in the acute stage respond well.

"Tuberculosis of various organs needs to be studied more extensively with streptomycin".

TUBERCULOSIS

Of recent years, several drugs have been found to be of some value in the control of tuberculosis in the experimental animal:—

Promin (Feldman *et al.*, 1940, 1942, 1943).

Promizole (Feldman, 1944).

Diazone (Callomon, 1943; Benson and Goodman, 1945).

(6) It should cause no greater fall in blood pressure when injected intravenously into cats on the basis of 300 microgrammes per kgm. than the equivalent of 0.1 microgramme per kgm. of histamine base.

(7) It contains no streptothricin.

(8) It forms a substantially clear solution with a pH of 5.0 to 7.0 when the dry streptomycin is reconstituted with sterile distilled water in a concentration of 50,000 microgrammes per c.cm.

(9) The expiration date of vials of streptomycin is eighteen months after the month during which the batch of streptomycin was released (refrigeration is required).

As is always liable to happen when a new method of treatment is introduced, there has been considerable confusion concerning unitage. Thus in the literature three methods of unitage are encountered, all based upon a method depending upon the inhibition of *B. coli*—S units, L units and G units. The last of these is now being generally adopted. This standard is based upon the weight of pure streptomycin base and by this standard:—

1 microgramme of streptomycin base equals 1 unit

1 milligramme " " " " 1,000 units

1 gramme " " " " 1,000,000 units

Fortunately the old and the new units are practically equal, so that little confusion is likely to arise.

METHOD OF ADMINISTRATION

Streptomycin may be given orally, intravenously, intramuscularly, subcutaneously, intrathecally, intraperitoneally, into the pleural cavity, or by inhalation. The most satisfactory route to use is the intramuscular one, by which adequate absorption takes place within a relatively short space of time. Keefer and his colleagues (1946) draw attention to the fact that 1 c.cm. of 1 per cent. procaine hydrochloride may be added to 4 c.cm. of solution to decrease the pain at the site of injection. The disadvantage of the intravenous route is that local damage to the vein, including thrombophlebitis, may occur. The use of the subcutaneous route is liable to be more painful than the intramuscular route. The intrathecal route is used in the treatment of meningitis, when it should be supplemented by intramuscular administration. Oral administration should be used in dealing with infections of the gastro-intestinal tract, although, of course, parenteral administration should also be used if there is any systemic involvement, e.g., in typhoid fever. Satisfactory results have been reported from the use of streptomycin by inhalation in pulmonary infections; an interesting feature in this connexion is that following inhalation of streptomycin, practically none can be detected in the blood.

DOSAGE

So many different factors are involved that it is difficult to give any general rule as to the amount of streptomycin that should be administered. This depends primarily upon the sensitivity of the organism as judged by

CONCLUSION

That streptomycin is going to play an important rôle in chemotherapeutics is abundantly clear. It does not replace penicillin; rather does it complement it. Its final standing has not yet been established and much work requires to be carried out in the way of clinical trials. The indications, at the moment, for the use of streptomycin are well defined: infections with organisms, particularly gram-negative ones, that are resistant to penicillin, should be treated with streptomycin.

So far as tuberculosis is concerned, the immediate position is clear. This is the most promising drug yet obtained for the control of tuberculous infections. It does not produce a dramatic cure and, in view of the clinical considerations, no final verdict can be given until prolonged clinical trials have been carried out. Unless these trials are adequately controlled, all that will happen will be that patients will submit themselves to treatment with streptomycin with no guarantee that their treatment will be any more efficacious than that which is carried out at the moment. It is only natural that even the possibility of a cure for tuberculosis should have aroused intense interest among laymen as well as in the profession but, in order to avoid unnecessary disappointment, it is essential that members of the medical profession should go out of their way to emphasize that in the present state of knowledge no guarantee of cure can be held out, and that the greatest good of the greatest number of tuberculosis victims will be obtained by restricting the present supplies of streptomycin to the treatment of patients under careful control. The alternative is that our present limited supplies (and even in the United States supplies are still limited) will be dissipated in such a way that it will be impossible in two or three years' time to give an answer to the question that is on everyone's lips at the moment—"Is streptomycin a cure for tuberculosis?"

How rapidly supplies of streptomycin will be forthcoming, either in the United States or in this country it is impossible to say, but it is probable that, to a certain extent at least, the story of penicillin will be repeated. Today, for instance, the monthly production of penicillin is said to be 360,000 mega units in this country, according to a statement made by the Minister of Supply in the House of Commons on October 28. Of this amount, 149,000 mega units are being exported. In the United States during July, 1,350,000 mega units, valued at 9,878,899 dollars were allocated for export; this is ten times the export sales of all drugs and medicines from the U.S.A. in an average month for 1938. Few people could have realized in the early days of the war, that the antibiotic produced with such great difficulty and at such great expense would, before the end of 1946, have attained this tremendous status.

The production of streptomycin is tending to follow the same pattern. As a result of increased production, the price is steadily falling; for instance, in the United States the price has been cut from 25 dollars to 16 dollars per

None of these, however, was found to be satisfactory. For a full review of the subject of the chemotherapy of tuberculosis, the reader is referred to D'Arcy Hart's Mitchell Lecture (1946).

When it was discovered that streptomycin was active against the tubercle bacillus, intensive study was immediately instituted, particularly by Feldman and his colleagues at the Mayo Clinic. They found that in guinea-pigs, continuous treatment over a period of six months resulted in a regression of tuberculous lesions in every instance (Feldman *et al.*, 1945). In 30 per cent. of the cases no residual infection could be detected, whilst in the remaining 70 per cent. there was no evidence of progressive disease but residual lesions could be demonstrated. This work has been confirmed both in the United States and in this country. Translated into clinical terms, very heavy dosage has been used in these experiments, but they are of importance as this is the first occasion on which it has proved possible to control the infection in the guinea-pig. Unfortunately the disease, as manifested in the guinea-pig, differs in many respects from the disease as seen in man and, as has been emphasized again and again by all workers on the subject, the results obtained are no more than suggestive so far as control of tuberculosis in man is concerned.

These warnings are amply confirmed by the results that have been obtained in man. The latest report is included in Keefer's comprehensive report and is based upon 75 patients.

In three patients with miliary tuberculosis, there was radiological evidence of improvement in the pulmonary lesions but all three died. Of seven patients with tuberculous meningitis, one died on the fifth day of treatment and six showed evidence of clinical improvement. Four of these are still alive but the outlook with regard to eventual prognosis is extremely doubtful; only one has a normal spinal fluid. The results of 24 cases of pulmonary tuberculosis were equivocal and only one of the eight patients with tuberculous empyema showed any improvement. No definite conclusions could be drawn from the findings in the few patients treated who had tuberculous peritonitis, lupus, renal tuberculosis or tuberculosis of the bones and joints. The official comment on these findings is: "It appears that streptomycin has a palliative effect in patients with tuberculosis. The results that have been observed in miliary tuberculosis, in tuberculous meningitis, in tuberculosis of the larynx, skin and renal tract, are highly suggestive that streptomycin exerts a bacteriostatic effect on the growth of the tubercle bacillus in man. The same can be said for exudative pulmonary tuberculosis. The time/dose relationship has not been worked out in detail. It is certain, however, that a maximum period of treatment should be three to six months with doses of 1.5 to 3.0 gm. a day. Only additional studies of well-controlled patients will define the place of streptomycin in the treatment of tuberculosis".

I know of four other references in the literature to the treatment of tuberculous meningitis with streptomycin. A report by Hinshaw *et al.* (1946) gives fuller details of the cases referred to by Keefer. The cases reported by Cairns *et al.* (1946) and by Reimann *et al.* (1945) both died in spite of treatment, whilst the case reported by Cooke *et al.* (1946) responded more satisfactorily and apparently the progress of the meningitis was arrested during treatment.

DRUG THERAPY IN BRONCHITIS

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MEDICINE owes a great deal to empiricism. Much might be written about the remarkable faculty which has enabled men in widely separated parts of the world to identify valuable remedies amid the welter of organic and inorganic material among which they live. We would need to go a long way back in history to identify the discoverers of the therapeutic virtues of alcoholic beverages skilfully used as sedatives, hypnotics and even as general anæsthetics; the man or woman who introduced bitters to revive a jaded appetite is lost in obscurity; mercury has come down to us from Chinese physicians who practised thousands of years ago, and despite a stormy passage through the centuries it retains its place in the British Pharmacopœia. Opium for pain, quinine in malaria, oil of chenopodium in worm infestations, digitalis in cardiac failure, and scores of other drugs in everyday use bear the same imprint of empiricism; their worth was established by the most ancient of all research techniques—the process of trial and error. As practising doctors, our plight would indeed be serious if we were deprived of this legacy. A clear realization of this fact is particularly desirable to-day, when there is a general tendency to assume that all the major advances in therapeutics belong to the twentieth century. A generation which has given us the sulphonamides and penicillin and has rationalized the use of vitamins and hormones is worthy of the highest praise, but it is desirable to view these advances in their proper perspective against the wide background of many centuries of progress in therapeutics.

The past fifty years have been especially notable for the application of the experimental method in clinical research. At last there is widespread acceptance of John Hunter's curt advice to Jenner: "Don't think; try". For too long the dead hand of authoritarianism has stifled initiative and suppressed inquisitiveness. Notwithstanding the great discoveries that men have stumbled upon in their searches for useful drugs, they have also been weighed down by the incubus of spurious remedies accumulated in ignorance and perpetuated by quackery. The magnitude of this burden can best be appreciated by perusing the pharmacopœias of the eighteenth and nineteenth centuries. The research worker in experimental therapeutics must be a double-headed Janus—looking back on the past and assessing by modern methods the value of old remedies; and looking forward into the future where the enterprise of clinician and pathologist is always indicating new possibilities in treatment.

gm., and this price will undoubtedly continue to fall, although how rapidly it is difficult to say. It is still, however, a costly drug. The minimum period of treatment for tuberculosis is three to six months, with a dosage of 1.5 to 3 gm. per day. A little simple arithmetic shows that even at the new price this involves a cost of approximately £750 for each patient, and we have no evidence to show that even at the end of this six months' period the patient will be cured. Indeed all the evidence suggests that further treatment will probably be required. Financial considerations, of course, should never be allowed to stand in the way of therapeutics. But it is neither unreasonable nor inhuman to suggest that the indiscriminate expenditure of such large sums of money is not justified unless we have some clear evidence that, as a result of the expenditure, tuberculous patients will really be, if not cured, at least in a much better position than they are as a result of current methods of treatment.

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that the doses of the "reflex expectorants" ammonium chloride, ipecacuanha and squill have been deliberately reduced to subemetic level. Furthermore, the possibility of any reflex effect upon the respiratory tract through the vagus nerve endings in the stomach is practically eliminated by allowing the drugs to mix with food and the post-prandial gastric secretion, whereby a very considerable degree of dilution must necessarily occur. If the rationale of prescribing reflex expectorants is accepted, it is difficult to see how any effect could possibly be attributed to the *usual methods of employing them in chronic bronchitis*. It need hardly be added that nauseating doses of "expectorant" mixtures are never ordered, for the simple reason that no intelligent patient would take them.

Most of the experimental work that has been performed on expectorants has been carried out on guinea-pigs, rabbits and cats. Perry and Boyd (1941) have worked out a technique for determining the exact output of "respiratory tract fluid" and of providing a means whereby it could be collected and analysed. Using this method for an evaluation of various cough syrups, Boyd reports in a recent paper that syrup of squill B.P. had no significant effect on the rate of output of respiratory tract fluid, even in a dose which would correspond to a *quart* taken by mouth by an average man on a body-weight basis. Whilst the negative result is noteworthy, perhaps the most important conclusion to be drawn is that with dosage of this order the results of such animal experiments bear no relationship to medical practice. Gordonoff (1938), on the other hand, claimed to have demonstrated the effectiveness of reflex expectorants in animals, but here again, on a basis of body weight, the doses used were gigantic. These painstaking researches have served to confirm what the practitioner has known for a very long time, i.e., that an evaluation of expectorants for the guidance of the clinician must be carried out on the human subject. It is apparent that man is much more sensitive to these drugs than are the lower animals, and the laboratory worker has told us nothing that was not already demonstrable in the case of the croupy child treated with an emetic dose of ipecacuanha wine.

The iodides of sodium and potassium are frequently included in expectorant mixtures because traces of iodide can be recovered from the sputum, and it is thought that the salts liquefy and increase the volume of the secretion. It must be remembered, however, that alkaline iodides are readily diffusible salts and can be found in many other secretions within a few minutes of their administration; there is clearly no selective excretion by the bronchial mucosa. That the presence of traces of sodium iodide in the respiratory tract fluid must have some physical effect can hardly be denied, but this is not to say that iodides necessarily have any important effect on the quantity or quality of the sputum secreted by a patient suffering from chronic bronchitis. Some authors point out that iodides are capable of causing intense coryza, cough and expectoration in people who have an idiosyncrasy

THE EXPECTORANTS

With these general considerations in mind we may perhaps more profitably review the actions and uses of that heterogeneous collection of drugs called expectorants. As in the case of so many empirical remedies, the title deeds for their inclusion in our formularies have long been lost.

The reflex expectorants.—It is safe to assume that even in remote times physicians sought for drugs that would facilitate or increase the flow of bronchial secretion. Almost inevitably they tried to imitate the phenomenon which is known to accompany bouts of nausea when both the salivary and the bronchial secretions are noticeably increased by spread of stimuli from an overactive vagus to the secretory nerve endings in the respiratory tract. The rationale was sound, and indeed the reasoning revealed commendable shrewdness and ingenuity. The method still finds practical application in the management of the non-diphtheritic croupy cough of young children: a substantial emetic dose of tincture of ipecacuanha is administered on a fasting stomach; within ten minutes the child turns pale, breaks out into a cold sweat and vomits or retches several times. The emetic action is accompanied by an outpouring of bronchial mucus which is removed by more or less violent coughing. The vomitus is a mixture of the contents of the stomach and upper respiratory tract. Such treatment, although unpleasant and depressing for the child, is undoubtedly effective in clearing stringy tenacious mucus from the trachea and larger bronchi, and may give striking relief in certain types of respiratory distress associated with acute tracheo-bronchitis. Ipecacuanha is therefore classified as a reflex expectorant; and in the same group acting in this indirect manner through the stomach are the vegetable drugs squill and senega and the inorganic salts ammonium chloride, ammonium carbonate and antimony potassium tartrate (tartar emetic). In parenthesis it might be added here that some of these are further described as "stimulating" and others as "depressing", not because of their effect on the output of sputum but because of their action upon the heart and cardiovascular system; thus ammonium carbonate is a stimulating expectorant, and among the depressing ones are ipecacuanha and preparations of antimony. These drugs are often administered in chronic bronchitis to liquefy the sputum and facilitate expectoration; and they are commonly combined in the same mixture in the hope that the total effect will exceed that of a large dose of a single expectorant. The following is a typical prescription:—

Ammonium chloride	..	..	..	..	4 grains (0.25 gm.)
Tincture of ipecacuanha	..	..	..	..	10 minims (0.6 c.cm.)
Tincture of squill	..	..	..	..	15 minims (0.9 c.cm.)
Syrup of tolu	..	..	..	..	30 minims (1.8 c.cm.)
Water	..	..	..	..	to 120 minims (7.2 c.cm.)

A dessertspoonful thrice daily after meals.

Now this and similar prescriptions are open to the fundamental objection

and hygiene, a subacute exacerbation almost invariably subsides spontaneously and the output of sputum falls progressively. Profuse expectoration is best left alone: the ordinary "expectorants" have no effect upon it one way or the other; drugs of the atropine group may diminish it, but simultaneously they make the patient uncomfortably "dry" and tend to aggravate constitutional symptoms, presumably through absorption of infected material retained in the lungs; pilocarpine and physostigmine may increase pulmonary secretion to the point of causing respiratory embarrassment and distressing side-effects of vagal activity, such as cold sweats, vomiting and diarrhoea. The paroxysms of coughing which are so common on waking and which last for a half to one hour should not usually be suppressed, as this is the natural mechanism for clearing from the bronchi the overnight accumulation of tough secretion. Draughts of hot water or hot tea are very acceptable at this time, and the ritual obviously has a rational basis in correcting the natural tendency to dehydration which occurs overnight and also in lubricating the fauces which are often in a dry irritable state after prolonged sleep. When the respiratory tract has been "emptied"—usually by about midday—it is justifiable to control the dry cough by means of codeine phosphate [1 grain (65 mgm.), four-hourly], which acts by rendering the cough centre less sensitive. Violent coughing may damage the mucosa of the larynx, fauces and soft palate, making them secondary foci of irritation which aggravate and perpetuate the coughing. This can be minimized by the use of demulcents in the form of lozenges, linctuses, honey, sweets or other confections, and usually the individual patient has his own preferences which are born of long experience. If ephedrine is used to give relief from the dyspnoea and wheeziness of bronchiolar spasm, it is important to prescribe it in small doses [$\frac{1}{2}$ grain (32 mgm.)], and it should not be given after about 4 p.m. as it may cause insomnia; excessive dosage often produces troublesome dysuria.

In contradistinction to the patient with acute bronchitis, patients with chronic bronchitis find steam inhalations disappointing; their effects too closely resemble those of the still, warm, muggy days which often cause a sense of oppression and respiratory distress to the sufferer from chronic bronchitis.

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for compounds of iodine, and it is implied that this phenomenon provides sufficient proof of the usefulness of iodides as expectorants. This curious assertion disregards the fact that iodism is a relatively rare occurrence; and when it does occur, far from its being welcomed as an indication of therapeutic success, it is the signal to discontinue the drug lest iodism develop in still more unpleasant forms.

It is generally agreed that the *balsamic expectorants* represented by tolu balsam are of no medicinal value, except as the traditional flavouring agents in cough mixtures.

Assessment of efficacy.—The direct approach to the problem of assessing the effectiveness of drugs described as expectorants is probably the most hopeful line of research, despite the obvious limitations of the method. The twenty-four hourly output of sputum is measured in a graduated tube. The volumes of the fluid secretion and the froth are noted and charted. Admixture of a certain amount of saliva with the respiratory tract fluid is unavoidable, but this is probably a fairly constant fraction of each mass of sputum voided, and we are chiefly concerned with *trends* in output rather than with absolute values. Using this technique several studies have been made (Alstead, 1939, 1940, 1941) and the conclusions may be stated briefly. In uncomplicated bronchitis spontaneous subsidence of a subacute exacerbation was accompanied by a gradual downward trend in the daily output of sputum; the smoothness of the curves in the graphic representation of these data is not without significance regarding the reliability of sputum measurement. Patients with bronchitis of long duration and who probably have developed some degree of bronchiectasis showed considerable fluctuations in the daily output of sputum. The opinions of patients as to the value of various mixtures were found to be wholly unreliable judging by their assessments of inert substances, such as cochineal in water. Ipecacuanha, ammonium carbonate, ammonium chloride and potassium iodide, given in average official doses three or four times daily after meals, produced no effect on sputum output which could not be attributed to spontaneous variations similar to those seen in the control period.

It may yet be proved that these drugs have a beneficial action of some kind on the patient suffering from chronic bronchitis. The onus of proof of such actions naturally lies upon the physicians who make the claims. At present it can at least be said that the accounts of the pharmacological actions of expectorants in man as written in standard textbooks receive no support from the results of direct observations carried out on patients.

GENERAL POINTS IN TREATMENT

The rational use of drugs in the treatment of patients with chronic bronchitis rests in the first place upon an understanding of the natural history of the disease. Given a few days' rest in bed and attention to nursing

on a perforated platform in a glass receptacle. In most cases a positive test is denoted by the extrusion of the eggs and can easily be observed with the naked eye in eight to twelve hours.

ACCURACY OF RESULTS

According to the accounts in the literature the degree of accuracy is very nearly equal in all four tests. There are, however, advantages and disadvantages in each. It is probable that the Aschheim-Zondek test is slightly more accurate than any of the others but the time taken to obtain a result is much longer. The *Xenopus laevis* test is interesting and accurate but, although normally there is little difficulty in importing the frogs from South Africa, there appear to be certain difficulties in the care and management and in the breeding of these animals in this country.

So far as I can judge, the test most widely used in this country is the Friedman test, and there is no doubt that it possesses a considerable degree of accuracy. Out of 645 Friedman tests done by Randall, Magarath and Pansch (1940) at the Mayo Clinic, ten gave a positive reaction in the absence of pregnancy and seven a negative reaction when pregnancy was present. In the *false negative reactions* three of the seven gave a positive reaction when the test was repeated a few days later. The number of false negative reactions obtained by these authors is small (about 3 per cent.). In my series of cases the number of false negatives has been rather larger. It is likely that a number of false negative results may depend upon the condition of the specimens of urine, especially if deteriorated owing to delay in the post. Nevertheless, repetition of the test after a ten days' interval has produced a positive result in the majority of the cases ultimately shown to be pregnant.

In my experience the number of *false positive reactions* has been considerably smaller than the number of false negative. It must be clearly understood that the word "false" is applicable only to the diagnosis of pregnancy and depends upon the conditions of the test, i.e., that the rabbit is injected with one intravenous dose of 8 to 15 c.cm. and killed forty-eight hours later. It is probable that if the test were used in a different class of case and a larger amount of urine injected than for the diagnosis of pregnancy a number of positive reactions might be obtained. The so-called false positive reactions have been found in a number of morbid conditions, e.g., in certain cases after the menopause when there is decrease of ovarian activity and increased activity of the anterior lobe of the pituitary; in certain menstrual disorders with primary ovarian dysfunction; in cases with low basal metabolic rate but not necessarily the clinical features of myxœdema; in certain ovarian neoplasms, and in patients treated with anterior pituitary extract.

RESULTS IN ABNORMAL PREGNANCIES

In cases in which there is a retained dead ovum, carneous mole or incomplete abortion the Aschheim-Zondek or the Friedman test may be positive or negative. In some cases it may remain positive for many weeks after the

THE LABORATORY DIAGNOSIS OF PREGNANCY

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The *Aschheim-Zondek test* for pregnancy (1928) depends upon the fact that during pregnancy there appears in the urine in considerable quantities a substance which is capable of producing a premature ripening of the Graafian follicles of the ovaries, as shown by the presence of hæmorrhage and luteinization. It was formerly thought that this was a hormone derived from the pituitary, but it is now believed that the effect is due to an anterior-pituitary-like substance produced by the chorion. The test requires six separate doses of urine spread over a period of forty-eight hours to be injected into each of five infantile female mice. A period of ninety-six hours is required before the result is obtained.

It is obvious that to carry out a number of Aschheim-Zondek tests as a routine procedure necessitates a considerable amount of time and trouble. There is also the additional difficulty of maintaining an adequate supply of suitable mice. Many workers therefore employ the *Friedman test* (Friedman and Lapham, 1931) in which a non-pregnant rabbit is used, but instead of injecting the urine thrice daily for two days in 4 c.cm. doses, one single intravenous dose of 8 to 15 c.cm. is usually given. The result is obtained in forty-eight hours after the first injection.

The rat may be used as a test animal in the diagnosis of pregnancy (Kupperman *et al.*, 1943). Both immature and mature female rats have been used. It has been shown that owing to the presence of the gonadotropic substances in the urine of the pregnant woman, a hyperæmic effect is produced upon the ovary and ovarian capsule in the immature rat, and in the mature animal the recent corpora lutea become dark red or purple in colour. These changes can be recognized by the naked eye. It is claimed that in the immature female rat a positive result can be obtained as early as two hours after injection and in the mature animal in six hours.

Hogben's test.—In 1930 it was shown by Hogben that extracts of the anterior lobe of the pituitary produced ovulation in the hypophysectomized mature female South African claw-toed frog (*Xenopus laevis*). Zwarenstein and Shapiro (1933), and Bellerby (1933), suggested that this animal should be used as a test for pregnancy. The female *Xenopus* carries eggs throughout the year but they are only set free as a result of mating. Two c.cm. of the untreated urine may be injected or the urine may be concentrated according to the method described by Weisman and Coates (1941). By this procedure the hormones are concentrated to forty times their strength by precipitation with acetone. One c.cm. of this concentrate is used. The injection is made into the dorsal lymph sac of the frog. The animal is placed

on a perforated platform in a glass receptacle. In most cases a positive test is denoted by the extrusion of the eggs and can easily be observed with the naked eye in eight to twelve hours.

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RESULTS IN ABNORMAL PREGNANCIES

In cases in which there is a retained dead ovum, carneous mole or incomplete abortion the Aschheim-Zondek or the Friedman test may be positive or negative. In some cases it may remain positive for many weeks after the

death of the ovum, depending upon the continued functional activity of the chorionic villi. A positive test cannot therefore be regarded as evidence that the fœtus is still alive. In the histological examination of retained products of conception, it is often impressive to note the good state of preservation of the chorionic villi after the lapse of many weeks. There appears to be no correlation between the microscopical appearance of the villi and the result of the pregnancy test. It is well known that a large proportion of cases of hydatidiform mole (15 to 30 per cent. according to different authorities) develop chorionepithelioma. This serious complication may also follow an abortion, rarely a full-term pregnancy or a tubal pregnancy. The suspicion of chorionepithelioma is aroused by the occurrence of vaginal hæmorrhage shortly, or in some cases a considerable time, after the termination of an abortion or full-term pregnancy. In cases of *hydatidiform mole* and *chorionepithelioma* a positive pregnancy test* may be obtained with both undiluted and diluted urine, but the extent to which the urine may be diluted and still give a positive reaction varies considerably. Cases of chorionepithelioma have been described in which the concentration of gonadotropic substance in the urine was such that a positive result was obtained with urine diluted 1 in 2000; in others, a positive result is obtained only with low dilutions, and it must be remembered that in normal pregnancy the test may be positive with urine diluted 1 in 100.

It may be necessary to repeat the Aschheim-Zondek or the Friedman test several times, and following the expulsion of a hydatidiform mole it is advisable to repeat the test at monthly intervals. A long latent period may elapse in some cases before the condition of chorionepithelioma develops sufficiently to give a positive reaction. A severe hæmorrhage may subside completely and give rise to a false sense of security only to reappear after a considerable interval, but the pregnancy test will usually prove to be a better guide as to what is actually taking place. Curettage of the uterus may prove to be a useful and necessary procedure and histological examination of curettings may show the appearances of chorionepithelioma. On the other hand, curettage may prove misleading and show no evidence of neoplasm because the malignant tissue is not present in the cavity but embedded in the wall of the uterus. In such circumstances the pregnancy test may be positive. Rarely, curettage may be positive and the pregnancy test negative. Diagnosis should therefore depend upon both procedures and also upon the clinical examination of the patient.

THE ESTIMATION OF PREGNANDIOL EXCRETION

Pregnandiol represents the excretion product of progesterone in the urine. Therefore under normal conditions it is found in the urine during the second half of the menstrual cycle from about the ninth day until a day or two before the beginning of the period. Should fertilization of the ovum

* The Aschheim-Zondek is preferred by some authorities to the Friedman test in these cases.

take place, the excretion of pregnandiol continues at or about the level attained in the latter half of the cycle. After a period of two to three months the curve of pregnandiol excretion rises steeply until one or two days after delivery, when it suddenly stops. It is considered that the sudden rise which occurs about the second or third month is due to excretion from the placenta. It has been suggested that the estimation of the pregnandiol in the urine might be used in the diagnosis of pregnancy. The average excretion at different stages of pregnancy has been determined, and the finding of an appropriate amount in the urine of a woman who has missed one or two periods would be highly suggestive of pregnancy. Guterman (1944) has recently described a test for pregnancy based upon a colour reaction of pregnandiol in the urine. The objection has been raised that a number of false negative results would be obtained in cases of early pregnancy, as at this period the figure of pregnandiol excretion is often no higher than that in the latter half of the cycle in a non-pregnant woman. The estimation of pregnandiol demands considerable time and expert technical assistance, and it would appear that further confirmatory work is required before the method is brought into general use.

Threatened abortion.—The estimation of the urinary pregnandiol may, however, be of great value in the question of threatened abortion. A fall in the excretion of pregnandiol may signify the danger of abortion. It has been shown that when pregnandiol excretion during the bleeding period increased spontaneously, or in response to treatment with progesterone, the bleeding ceased and pregnancy continued. Failure of pregnandiol excretion to increase from a low level was followed by abortion. In cases of repeated abortion, quantitative estimation of pregnandiol may throw some light upon the functional integrity of the corpus luteum. A high excretion of pregnandiol does not necessarily accompany a positive Aschheim-Zondek or Friedman test. For example, hydatidiform mole and certain tumours of the testicle give positive pregnancy tests, but in these cases the estimation of pregnandiol gives negative results.

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THE BUYING, COOKING AND SERVING OF FOOD

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FROM summaries of dietary histories taken in the out-patient department, the following is a very fair average of the type of diet consumed by children attending the hospital.

(1) A high consumption of carbohydrate foods in the form of packet breakfast cereals, bread, buns, cakes and biscuits.

(2) A low consumption of the protective foods—milk, cheese, eggs, meat, fish, oatmeal, vegetables, salads, fresh and dried fruits: foods which contain proteins, calcium, phosphorus, iron and vitamins, all necessary for growth and health.

It is clear that many children with symptoms of other clinical conditions can also suffer from malnutrition; when they are admitted into hospital and fed on a good mixed diet the general improvement in their condition is well marked. It has been said that malnutrition is like an iceberg; only one-third of it is visible.

THE MAIN REASONS FOR UNBALANCED DIETS

(1) Insufficient knowledge of nutrition and of the buying and cooking of the right kinds of food.

(2) Lack of time in which to prepare meals; also, in some cases, insufficient money to buy the more expensive protein foods.

(3) Laziness and lack of initiative on the part of the mothers.

BUYING

Milk.—Under the National Milk Scheme, all children under five years of age are allowed one pint of milk per day at twopenny per pint, and in special circumstances it is issued free of charge. It should be the responsibility of those in charge of young children to see that each child is given his full allowance of milk each day. Dried household skimmed milk contains as much protein, calcium, riboflavin and nicotinic acid as liquid milk; the allocation should be bought and used as an addition to the diet for making puddings, soups, sauces, mock cream, and for adding to mashed potatoes.

Cheese.—Cheese is a concentrated protein food. One ounce of Cheddar cheese contains one-and-a-half times as much calcium as the average shell egg weighing 2 ounces. It is also a good source of vitamin A, thiamin, riboflavin and nicotinic acid. For children of two years and over, it should be grated and made into sandwiches, or sprinkled over salads and soups or mixed with mashed potatoes. Weight for weight, the harder the cheese the

more nutritious it is, as the water content is less than in soft cheese. The Empire Cheddar type of cheese is very suitable for children; it grates well and is bland in flavour.

Eggs.—Eggs should be given to children as often as possible. An egg has a high food value, the fat is easily assimilated and the iron is in an available form. Eggs contain fat-soluble vitamins A and D and riboflavin. Dried eggs contain the same nutritive properties as shell eggs and should be used in the making of custards, scrambled eggs, omelets and in cooking.

Butter and margarine.—With few exceptions, every child should eat its full weekly ration. Modern margarine is highly nutritious and is fortified with the fat-soluble vitamins A and D. One ounce of margarine is equal, in calorific value, to one ounce of butter.

Bacon.—Bacon contains iron, thiamin, riboflavin and nicotinic acid. During the smoking process it is partially cooked and is quite easily digested by young children when grilled or fried. The cheaper cuts, spring or thin flank, when boiled and served cold with raw vegetable salad and potatoes, provide the child with a highly nourishing and appetizing meal.

MEAT.—To save shipping space the bulk of imported meat is boned before it is sent to this country and the once familiar joints have temporarily disappeared; to the untrained eye it is often difficult to recognize any particular joint. The tenderness of meat is dependent upon the length of the bundle of muscle fibres, the shortest muscle fibres are along the back and top of the animal. The most tender joints are the sirloin, loin, fore and middle ribs. The most tender meat is breast of chicken. Tougher joints are the leg, shin, neck and flank, in which the bundles of muscle fibres are longer. The price of meat is no guide to the nutritional qualities of the joint. Imported meat at a shilling per pound contains the same amount of protein, riboflavin and nicotinic acid as home-fed meat at one shilling and sixpence per pound. The younger the meat, the higher the percentage of water it contains, i.e. veal consists of 75 per cent. water.

Pork should not be given to young children: a large amount of fat is interspersed between the muscle fibres, which tends to form an impervious envelope around the fibres, preventing the digestive juices gaining access.

Corned beef is a valuable addition to the dietary of a child, it contains nearly as much iron as liver and has the additional advantage of being cooked ready for eating.

Liver should be given to children whenever possible. When lightly cooked, it is digested by quite young children. One ounce of liver contains four milligrammes of iron. It is a rich source of vitamin A and thiamin; riboflavin, nicotinic acid and pyridoxine, are present in varying amounts.

Sweetbread is the pancreas of the sheep and ox and the thymus of the lamb and calf; both are rich in phosphorus. It is easily digested and can be introduced into a weaning diet.

Sausages are popular with children and, when served with mashed potatoes and a green vegetable, provide a nourishing meal. The protein

content of sausages is low, but when dried household milk is added to the mashed potatoes the deficiency is made good.

Tripe is the lining of ruminant stomach of ox. It contains a large amount of collagen which is converted into gelatin when cooked. As it contains no extractives, it lacks flavour. When stewed with a good variety of root vegetables, it is quite well liked by most children.

FISH.—Fish should smell fresh and be firm to the touch, the tail and fins should be stiff, the eyes prominent and bright, the colour bright and fresh. Fresh plaice have deep orange spots on their dark surface which fade as the fish becomes stale. The nutritive value of fish varies with the type of fish; fat fish, in which the fat is distributed throughout the body of the fish, such as herrings and mackerel, yield a higher calorie value, weight for weight, than the white fish, cod or fresh haddock. The fat fish is also a rich source of the fat-soluble vitamins A and D. Fish protein is equal in nutritive value to any other animal protein; it has a higher water content and more collagen than meat. One-and-a-half ounces of white fish or one-and-a-quarter ounces of fat fish are equal in protein to one ounce of meat.

Points should be used to buy *tinned fish* for children. Sardines, pilchards and salmon all contain calcium, iron and the fat-soluble vitamins A and D.

Shell fish.—Lobsters, crabs, whelks and winkles all have dense fibrous tissue and, for this reason, are not suitable in the diets of small children.

VEGETABLES.—The problem of buying fresh vegetables is a very real one to town dwellers; much can be done to restore wilted green vegetables by cutting a slice off the end of the vegetable, if it is a cabbage or cauliflower, and placing it in cold water for about two to three hours before the final preparation for cooking. The ideal is to buy fresh vegetables direct from the grower, but this can only be achieved by the suburban or country dweller.

Root vegetables should feel hard and firm and appear free from disease.

Canned vegetables retain all the properties of fresh vegetables and should be used for children when fresh vegetables are in short supply.

Dehydrated root vegetables are now being used; after soaking in water, the consistency and flavour are restored.

Potatoes are a cheap source of carbohydrate and minerals and, in the winter months, provide a stable source of vitamin C when other vegetables are in short supply.

Carrots, swedes and turnips contain variable amounts of calcium, iron, thiamin and vitamin C. Carrots contain large amounts of carotene. All these vegetables, when shredded, can be included in winter salads for older children but, for the toddler and small child, they are better digested when cooked.

Salad vegetables.—Watercress, mustard and cress, lettuce, raw shredded brussels sprouts and raw tender cabbage should be given to older children as often as possible. They are good sources of vitamin C, iron and calcium.

Tomatoes, whenever they are obtainable, should be included in children's

diets; infants can be given strained tomato juice, which contains large amounts of carotene and vitamin C and some thiamin.

Dried peas, beans and lentils.—Points spent on these foods are well spent. In their dry state, they contain weight for weight as much protein as meat, but the protein is lacking in cystine. This deficiency can be balanced by the use of a complete protein, such as meat, bacon, cheese or eggs, and the pulses are a valuable addition to the meagre ration of protein foods. All the pulses are good sources of iron, calcium, thiamin and pyridoxine.

CEREALS.—*Soya bean flour* has a high nutritive value and contains a high percentage of protein, fat, calcium and iron. It can be used in soups and broths for toddlers and as an addition to wheat flour for cooking purposes in the proportion of one-sixth to five-sixths flour.

Oatmeal is a good addition to a child's diet. It supplies protein, fat, calcium, iron and thiamin. Oatmeal porridge, cakes and biscuits can be given to the toddler.

Rolled oats are partially cooked during the rolling process; they therefore require less cooking than oatmeal.

Semolina obtained from the aleurone of the wheat grain contains good wheat protein, iron and thiamin.

FRUIT.—*Fresh fruits.*—These should be bought for children whenever there is an allocation. Summer fruits, especially strawberries and black currants, have a high vitamin C content; the citrous fruits are next in value. Except for Bramley seedlings, apples contain negligible amounts of vitamin C, but they contain laxative properties which may be valuable to some children. Unripe apples should not be eaten raw by young children; they contain a large amount of starch which is converted into fructose as the apples ripen.

Dried fruits.—Prunes, dates, figs, raisins, sultanas and apricots have a concentrated nutritive value; they are also good sources of iron and calcium and so are valuable in children's diets when fresh fruit is in short supply.

TREACLE.—When there are points to spare for this commodity it should be bought. Black treacle is of special value to children as it contains 141 mgm. of calcium and 2.6 mgm. of iron per ounce and is very suitable for making treacle tart and oat cakes.

COOKING

MEAT.—Meat and vegetable protein is coagulated at 160° F. (71.1° C.). In the cooking of meat the colour of the hæmoglobin should be the guiding factor; this is parallel with the amount of heat employed in the cooking. The amount of heat required for the easy digestion of meat should not be sufficient to change the colour of the hæmoglobin from red to brown. When preparing meat for young children, it should be finely divided by mincing before cooking. The collagen in meat loses tyrosine when being cooked; this causes it to be converted into soluble gelatin. When cooked meat

is used in made-up dishes, the meat should only be reheated, not recooked.

Baking.—This is a process of cooking by the circulation of hot air around the food inside an oven. Meat should stand on a rack placed inside the baking tin to allow the heated air to circulate freely under the meat. If the meat is lean, a small amount of dripping in the baking tin is an advantage. As meat is a slow conductor of heat, it requires not less than forty-five minutes per pound at an oven temperature of 330° F. (165.5° C.). A certain amount of shrinkage takes place during cooking as water is evaporated from the meat. Shrinkage and overcooking of a small joint can be avoided in baking by coating the meat with a pastry case which can be eaten as an accompaniment with the meat. The surface of meat should not be punctured by piercing with a sharp instrument during cooking. A nutritious gravy can be made by using vegetable water and a small quantity of marmite.

Braising is a combination of dry and moist cooking. It is a suitable method to employ for cooking the cheaper and tougher joints and small pieces of meat. An oven casserole with a well-fitting lid is suitable for this type of cooking. The surplus fat is trimmed off the meat, which is then lightly fried on both sides, the prepared vegetables are sliced and browned in the frying pan; they are then placed in the casserole to form a foundation or bed for the meat. The culinary term for the bed of vegetables is *mirepoix*. Sufficient seasoned stock is added to surround the vegetables without covering them; the meat is placed on the *mirepoix*. The casserole is put into a moderately hot oven and the meat is cooked in the savoury vapour of the vegetables. An hour should be allowed for cooking small pieces of meat.

Stewing, from an economical point of view, is an excellent method of cooking meat for children. Many of the cheaper joints of meat containing collagen can be used, such as shin of beef, knuckle of veal and scrag-end of mutton. Any vegetables in season can be used for flavouring. All surplus fat should be removed from the meat, which is cut into convenient-sized pieces, and sufficient bone or vegetable stock added to cover the stew, but not more. The correct heat required for stewing is 180° F. (82.2° C.); a stew should never boil. To obtain the best results, stewing is a process of long, slow cooking.

Steaming is a cooking process employing heated vapour. It is very suitable for cooking puddings when a light sponge-like mixture is desired, but it is not an economical one to employ in the cooking of meat and fish as many of the soluble nutrients escape into the water contained in the steamer; also greater shrinkage of the food takes place than from dry cooking. High-pressure steamers, as used in large-scale cooking, are valuable; the temperature can be raised considerably above boiling point and food cooked very quickly. This method is suitable for cooking root vegetables on a large scale.

Frying.—In the employment of this method the fat content of the diet is raised by absorption of fat by the food, a point to remember when a reducing diet is required. Fat used for frying should reach 360° F. (193.3°C.)

before being used. When this temperature is reached, a blue smoke is seen to rise from it. Shallow frying is the term applied when only sufficient fat is allowed to prevent food adhering to the bottom of the pan; suitable for bacon, sausages, cutlets and vegetables. Deep fat frying is a more economical method for large-scale frying; less fat is absorbed by the food and the fat, when taken care of, can be used for a considerable time.

Fried food is appetizing and popular with children. When batter or egg and breadcrumbs is used for coating fried food, this should be removed before serving it to the toddler, in order to facilitate digestion. It is estimated that the vitamin C loss in chip potatoes is 20 per cent. less than when potatoes are boiled.

VEGETABLES.—Vegetables should not be prepared longer than absolutely necessary before cooking; a high percentage of vitamin C is lost when they are left to soak in water for a long period.

All *green vegetables* should be thoroughly cleansed in cold salted water immediately before they are required. Shred cabbage, and cook in a small amount of boiling salted water for fifteen minutes in a saucepan with the lid on. In large-scale cooking it is possible to achieve this by cooking small quantities of vegetables in relays; in this hospital, cabbage is cooked just before the serving of each meal, thus making it possible for everyone to have freshly cooked vegetable.

Carrots, swedes and turnips.—Old vegetables should be sliced and cooked in the minimum amount of boiling salted water; the water should be saved and used for soups and gravy.

CEREALS.—*Moist heat* softens the cellulose envelope of whole grain cereals, the starch cells absorb water and rupture the starch, becoming gelatinous. The texture of whole grain pudding, made with barley or rice, is improved with long slow cooking.

Dry heat dextrinizes starch. The golden brown crust of bread, cake and biscuits contains dextrin. Dry heat converts sugar into caramel and carbon. Wet heat has no effect upon sugar beyond dissolving it. In the process of jam making, some of the sugar is hydrolysed into a reducing sugar fructose by the acid in the fruit.

RAISING AGENTS USED IN COOKING.—Flour and water dough, unless aerated, is close, heavy and indigestible. *Yeast* is the most valuable raising agent, from a nutritive point of view. It contains protein of good biological value and is rich in thermostable vitamins, riboflavin, nicotinic acid and pyridoxine. When yeast cells are provided with carbohydrate, nitrogen, water and warmth, they grow and multiply rapidly. Alcohol and carbon dioxide are given off as waste products which permeate through the dough and a light spongy mass is formed. The yeast cells are killed by the oven heat, the molecules of carbon dioxide continue to expand and the dough rises still more, until finally the surface of the dough is dextrinized and a firm brown crust is formed. In the dietary of children in this

hospital, yeast is used in the making of buns, rolls and pastries.

Baking powder.—The active raising property is carbon dioxide which is given off when the alkali and acid in the powder is made wet. It has been proved that a loss of thiamin takes place by its use in cooking; this may be due to the fact that thiamin is known to be destroyed in alkaline mediums.

Introduction of cold air is accomplished by the use of whisked egg whites, as in soufflés and sponge cake mixtures. Air can be beaten into mixtures as in batter; the principle is the same: cold air expands and rises on heating and pushes up the elastic gluten in the flour, which is set by the heat from oven or stove top before it can collapse.

SERVING

Meals should be served punctually; this is important when catering for young children. A certain amount of time should be spent on the preparation of the child for his meal, such as attention to hands and face and placing a feeder or table napkin around his neck, and in placing the child in a comfortable position to enjoy his food; all this will help to produce a quiet, restful state of mind necessary for good digestion. Children are conservative and dislike changes from food to which they are accustomed. Introduce new flavours and new kinds of food into the diet slowly, together with some other food with which they are familiar. Serve small quantities on to plates and dishes not larger than is necessary; a child will often ask for a second helping when the first helping is small, but when given a large helping first will not finish it, and the food is wasted. It has been observed that certain sick children show a strong aversion to any form of assistance with feeding. Food will be rejected when any attempt is made at spoon feeding, but when left alone to feed themselves all the meal will be eaten.

Whenever possible, give a child an individual jelly, coloured mould or other pudding made in an individual dish. The older child's appetite and flow of gastric juice are stimulated by the pleasant smell of food cooking but the toddler's conditioned reflex is not so well developed to savoury smells, and colour makes a stronger appeal to appetite and interest in food. Care should be taken in garnishing the food. Contrasting colours can be provided by the judicious use of salad and root vegetables, coloured fruit and jelly. A coloured tray cloth and pretty china add to the general appearance of the food as a whole.

Water and fruit drinks served with a meal are not detrimental to good digestion. Hot food should be served on to hot plates and covered with plate covers to prevent it cooling down and becoming lukewarm before the child receives it. It is customary to serve animal protein first and the carbohydrate course at the end of the meal, but there is no infallible physiological reason why any hard and fast rule should be observed if a sick child prefers to eat the sweet course at the beginning of the meal; but the child's appetite should not be allowed to be satisfied with this course only.

PAIN AND ITS PROBLEMS

II.—SOME CLINICAL ASPECTS OF PAIN

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PAIN is such a common experience that to attempt a definition of it is not necessary; in fact, a definition that would at the same time be adequately inclusive and sufficiently restricted is scarcely possible. Other abnormal subjective experiences not usually described as painful, such as itching, tingling and sensation of heat and cold, may, when intense, actually amount to pain. In the past it was often regarded, mainly by psychologists, as merely a state of feeling, but anatomical, physiological and clinical evidence has now determined beyond doubt that pain is a specific sensation subserved by its own nervous apparatus.

THE PHYSIOLOGICAL PROCESSES OF PAIN

In addition to pain as a symptom presented by the patient the clinician has to consider tenderness, or abnormal susceptibility to pain, and observe the reflex and emotional reactions that are frequently associated with it. It is often advisable to determine the state of sensation in the area to which it is referred, for there may be either true hyperæsthesia, that is, increased sensibility to threshold stimuli, or merely over-reaction to stimuli above threshold value. On the other hand, analgesia, or reduced sensibility to pin-prick and other stimuli, is found if conduction through afferent nerve fibres is impaired; this, for instance, is almost constant in *tabes dorsalis*.

Professor Adrian has dealt with the peripheral receptors of pain-producing stimuli and the nerve fibres that carry impulses from them through the posterior spinal roots to the posterior horns of the cord; here these peripheral fibres end around nerve cells. A second relay of fibres that arises from these cells decussates in the posterior commissure of the cord and ascends along its antero-lateral border to the brain stem. Interruption of these causes insensitiveness of the opposite side of the body to all pain-giving stimuli without disturbance of any other form of sensation, but thermal sensibility is lost in the same area if the fibres that carry impulses excited by heat or cold, which run in close contiguity to the pain tract, are also involved. Persistent refractory pain can be permanently relieved by surgical division of these pain-conducting fibres where they lie on the lateral surface of the cord.

The tracts that convey pain and thermal impulses also lie on the lateral surface of the medulla separate from the main sensory system, but in the pons they join the median fillet and with it end in the ventro-lateral nucleus

of the thalamus. This is almost certainly the main perceptive centre for the affective aspects of pain. No lesion of the cerebral cortex, no matter where situated or how extensive, abolishes perception of pain or materially reduces sensibility to it, whilst destruction of the lateral portion of the thalamus renders the opposite side of the body analgesic. Lower animals, too, react to painful stimuli of approximately normal threshold value after complete removal of the cortex, and in some reactions expressive of pain, such as whining, snarling, barking and efforts to escape, can be elicited from even lower levels in the midbrain. These, which Sherrington has called "pseudo-affective reactions", can be obtained after decerebration or removal of the thalamus. Somewhat similar reactions have been obtained by stimulation of the hypothalamus when the rest of the brain has been destroyed. This observation is significant, as there are firm grounds for regarding the hypothalamus as a higher integrating centre for such autonomic reactions as accompany severe pain. Clinical experience, however, suggests that the functions of these lower levels which react to painful stimuli have, like other functions, moved farther cerebral-wards in man.

Although pain affects consciousness through the thalamus the cortex must be responsible for the accurate localization and discrimination of stimuli that excite it. Recognition of its site and of its special features may be disturbed by disease of the sensory cortex. It must be remembered, however, that pain-producing stimuli almost invariably excite other forms of sensation: a pin-prick touch or pressure and a feeling of penetration of the skin, a bruise pressure; whereas burning is accompanied by a sensation of heat. It is probable that these sensations evoked at the same time as pain provide the basis of localization and discrimination.

The central nervous system, although the organ of sensation, is insensitive to injury: in the conscious patient under a local anaesthetic it can be incised, burned with a cautery and otherwise damaged without evoking sensation; and with few exceptions no disease or injury involving it causes pain unless sensory roots, parts of the meninges and possibly some of the larger vessels are also involved. The only important exception, though luckily a rare one, is the "thalamic syndrome" due to a softening in the lateral aspect of the thalamus, which is characterized by intense pain of the opposite side of the body that may persist unaltered for years. It is mainly an exaggerated response to stimuli that possess affective tone, such as pricking, pinching and degrees of heat and cold uncomfortable to normal parts. The threshold to painful stimuli is, however, raised. This over-reaction to painful stimuli has been attributed by Head and Holmes (1912) to interruption of the inhibitory influence by which the cortex normally controls reactions of the pain centre in the thalamus; it is analogous to the increase of muscle tone in the spastic limbs of the hemiplegic.

On the other hand, sensory nerves from their termination in the skin and deeper tissues to their entry into the spinal cord are exquisitely tender to

various agents that threaten, or may threaten, injury to the body. Pain that radiates over the corresponding segment of the body may be due to compression, inflammation and other affections of a posterior spinal root. If these are irritable, owing to disease of any nature, pain may also be excited by an abrupt change in the pressure of the cerebrospinal fluid, as occurs in coughing, sneezing and straining. There is generally some diminution of sensibility on the segment to which it is referred.

INJURED OR SEVERED NERVE FIBRES

It is a common experience that nerve trunks are tender to pressure and other stimuli and that irritation of them produces pain. Tenderness is increased by many pathological conditions, such as neuritis, inflammation of them or of surrounding tissues, and by compression, and may be accompanied by more or less continuous pain. Two conditions, however, require further consideration—pain in an amputation stump that may be referred to a phantom limb, and causalgia. These are to some extent allied.

Phantom limb.—The neuroma that often develops on the proximal end of a divided nerve consists of numerous naked fibres and of others without fully developed sheaths embedded in a mass of new tissue, and is frequently sensitive to pressure and traction. It may also be a source of pain apart from external excitation which may be referred to a phantom extremity. The most satisfactory explanation of this spontaneous pain is that put forward by Professor Adrian (1947), that efferent currents spread to afferent fibres when they are not properly insulated.

Causalgia, which most often develops after gunshot wounds which injure but do not divide completely the median or sciatic nerve, is characterized by intractable pain of a burning nature in the area of distribution of the injured nerve and an exquisite tenderness to various stimuli. It is usually accompanied by trophic changes in the skin, vasomotor disturbances and sweating, and may be aggravated by movement or jarring of the limb, and even by noise or emotion. No wholly satisfactory explanation of it has been suggested, but the association with it of symptoms of autonomic origin and the fact that frequently it can be relieved by sympathectomy indicate that involvement of sympathetic fibres is necessary for its appearance. It may be that efferent fibres in the walls of neighbouring vessels are injured as well as the nerve and that short circuiting or spread of currents from fibre to fibre, as Professor Adrian suggests, is responsible. Doupe, Cullen and Chance (1944) suggest that it may be due to stimulation of sensory fibres by efferent impulses in sympathetic fibres.

More commonly, pain and tenderness result from injury or disease that involves the terminal filaments of nerves or their end-organs. It has been attributed to their stimulation by compression and other mechanical factors, but Lewis's hypothesis, that it is due to liberation of a "pain-giving substance" from injured cells which excites them directly, or increases

their excitability, is a more satisfactory explanation of the more or less identical effects of a great number of agents. Tenderness of the injured parts is the outward manifestation of this increased excitability. The pain threshold is often lowered, particularly to large stimuli, by superficial lesions, as by burns, sunburn and exposure of nerve endings, but may be raised to small pain-producing excitants, such as pin-pricks, for although the end organs are over-excitabile, conduction through their fibres may be impeded.

The tenderness often present in the area of a regenerating sensory nerve is probably also attributable to irritability of the inadequately protected terminal portions of immature fibres. Tinel (1917) has pointed out that growth of new fibres can often be measured by the downward extension of this tenderness.

VISCERAL PAIN

Afferent fibres pass to the spinal cord from most of the viscera or from their envelopes and attachments, but although they run part of their way through sympathetic strands and white rami communicantes they belong to the somatic, not to the autonomic, nervous system. Some are concerned in reflexes that control visceral functions; it is still in doubt if impulses they carry central-wards evoke sensation.

It is generally agreed that most of the viscera are insensitive to stimuli that excite pain in somatic structures, such as pressure, cutting, or burning. This is not surprising, for as they are not normally exposed to such traumas it cannot be expected that they would be endowed with a nervous apparatus to respond to them. In other words these stimuli are not adequate. Abnormal or violent contractions of hollow viscera, such as the alimentary tract and ureters, may, however, cause severe pain.

The parietal peritoneum, the pleura and many blood vessels are sensitive to various injuries, such as handling, stretching and cutting. The mesentery is also sensitive and the pain associated with disease of the viscera is believed by some to originate in these structures.

To Wolff (1943) we owe significant observations. He was able to study the effects of various stimuli applied directly to the mucous membrane of the stomach through a large gastric stoma. Pricking, faradization, alcohol, acids and alkalis caused no discomfort, but when the gastric mucosa was inflamed or congested these agents evoked pain of considerable intensity. The pain produced by contraction or distension of the stomach was also greater when its mucosa was inflamed. Wolff also suggests that it emanates mainly from the muscular and serous coats.

If these conclusions are valid for the rest of the alimentary tract it would seem that pain originates in it only when its mucosa is inflamed, ulcerated or otherwise abnormal.

Whether pain originates from visceral organs or only from effects of their disease on adjacent structures, it has certain characteristic features, although

its character may vary with the part involved and the nature of the disease. In contrast to cutaneous pain, it is usually more diffuse, less accurately localized, aching, "sickly", and less tolerable in relation to its intensity.

REFERRED PAIN

The occurrence of pain at a distant site, frequently on the surface of the body, in association with disease of visceral organs has, during the past sixty years, attracted the attention of several English physicians (Sturge, Ross, Mackenzie and Head). Pain at the right shoulder, which is a common symptom of irritation of the diaphragm and of disease of the liver that affects its peritoneal surface, is a typical instance. Such pain may be apparently spontaneous, that is, it occurs apart from excitation of the skin or deeper structures, or it may appear as tenderness to stimuli that normally produce no discomfort.

Sturge's original suggestion (1883) was that, owing to the arrival of a long-continued and excessive train of impulses at that level of the spinal cord which receives messages from the diseased organ, a state of abnormal irritability develops in its grey matter and consequently other impulses that pass through it are so augmented that they affect consciousness as pain. And as afferent impressions from viscera and from tissues adjacent to them are not, even when they affect consciousness, accurately localized, the pain is referred to the surface of the body from which localizable stimuli normally reach the irritable spinal centre. For instance, afferent fibres in the phrenic nerves convey to the third, fourth and fifth cervical segments of the cord impulses that normally do not evoke sensations; but when these impulses become so intense that they evoke pain, they are judged to have come from the region that sends localizable impulses to these segments, that is, the skin around the shoulder. Sturge's hypothesis has been accepted with modifications by Ross (1888), Mackenzie (1909), Head (1894) and others.

Further, stimuli that under normal conditions cause no discomfort, such as rubbing, scraping and pressure may, when they reach the irritable spinal centre from the region to which pain is referred, start excessive reactions which affect consciousness as pain. Some observers, e.g. Lewis (1942), report a surface hyperalgesia, that is, lowering of the threshold to painful stimuli, but according to others, e.g. Wolff, the threshold is not altered but the pain normally produced by the stimulus is intensified. Some have found that referred pain is relieved by anæsthetization of the skin, but others have failed to confirm this. It may be that referred pain is unaffected, but tenderness to painful and other stimuli is reduced or abolished by the local anæsthetic.

Lewis and others have criticized this interpretation of referred pain and tenderness, but it seems the simplest explanation of the phenomena. There

is also physiological evidence that afferent impulses may lower the threshold or increase the excitability of the grey matter of the spinal cord in which they arrive. For example, two stimuli, neither of which is sufficiently intense to evoke a reflex, may be effective if applied in succession within an adequate interval of time; the first lowers the threshold of the reflex centre. Sherrington has introduced the term "central excitatory state" for "an enduring excitatory condition set up by a centripetal volley in the reflex centre". Such an excitatory condition in the spinal cord can explain other clinical phenomena, such as tenderness of the skin around a diseased joint and the exaggeration of the knee-jerk often associated with arthritis of the hip or knee.

THE ESTIMATION OF PAIN

Pain is so wholly subjective that an accurate estimate of its severity is always difficult: there is no objective measure of pain. The physician must rely on the patient's statements, his reaction to it and, above all, on an appraisal of his personality, for both descriptions and reactions depend largely upon the psychological background. The neurotic usually describes his symptoms in grossly exaggerated terms; the subject of a chronic painful illness is often surprisingly silent or relatively indifferent. Martyrologies tell us of intense sufferings borne without a whimper: the subject of a traumatic neurosis wearies us with repeated complaints. Interest in or attention to it determines largely the outward manifestation of pain. Even sitting on a chair becomes first uncomfortable and finally almost intolerable if the attention is fixed rigidly on the sensations produced by its pressure on the body. The physician's experience and his insight into the patient's character often prove the most reliable gauge.

Physical signs, apart from the patient's reactions, are rarely helpful. Severe abdominal pain is often accompanied by a rise of pulse rate and a fall in blood pressure, but during a bout of *tic douloureux*, with an intensity of pain probably unparalleled, there may be no circulatory change.

Whether the pain of which a patient complains is real in the sense that it is due to injury, disease or disorder of function, or is, as it is in hysteria and traumatic neurosis, the translation of an idea into a symptom, or is simulated by a malingerer, is a more important question. And it is frequently a question not easy to decide, particularly as the pain of which the hysterical patient or the malingerer complains often follows an injury or painful experience of other nature. Hysterical perseveration of symptoms originally of physical origin is notoriously common.

There are, however, certain features that often enable us to distinguish what I may call "real pain" from that complained of by the neurotic and malingerer. Its character in relation to its site and assumed cause is often suggestive. Its distribution and the description of it which the sufferer supplies frequently differ from that with which the physician is familiar in

organic disease. The feeling of weight on, or constriction as by a tight band of, the head is almost pathognomonic of the neurasthenic headache. But we can rarely rely on descriptions alone.

Simulated pain and that of neurotic origin are almost invariably associated with pronounced tenderness of the area to which they are referred. Tenderness in a region of pain is of course common in physical disease, but it is seldom so prominent, or evokes such an exaggerated reaction, unless there is obvious or discoverable cause for it. Variations in the degree of tenderness and even of its position are more important features of pain of psychological origin. If the observer marks carefully the spot on which pressure evokes a strong reaction he may find that when the patient's attention is diverted by questioning on other matters, or during examination of another part, such as the chest or abdomen, even firm pressure elicits no response or a reaction only when the patient has become aware of the stimulus. Another useful test is to mark the spot that is tender to pin-prick or pressure and then approach it slowly by a series of stimuli from a distant part, asking the patient to indicate immediately when the spot is reached. Then, preferably after a short interval, repeat the test by approaching the spot from the opposite direction. In organic disease the tender spot naturally remains constant, but the hysterical patient and malingerer frequently place it in different sites, perhaps inches apart. When in this test pin-pricks are repeated at short intervals the tender area is often displaced beyond its originally indicated position, if slowly or at long intervals in the opposite direction.

Observation frequently reveals, too, incompatibility between the neurotic patient's complaints and the functions of the affected parts: an arm too painful to move may be used to point to another part on which his attention is temporarily focused, or a painful leg may be moved unexpectedly well in walking. Finally, reflex contractions of muscles to ensure rest of a painful part, redness, heat or swelling do not appear in functional conditions, although voluntary fixation of the part to which the patient refers his symptoms must be distinguished.

INVESTIGATION OF PAIN

The advantages of the systematic investigation of any symptom is that it assures completeness and saves time as compared with a haphazard examination, but such a system must be modifiable to meet the many different conditions the clinician encounters. The following scheme may prove useful in a search into the nature and cause of pain.

In taking the patient's history, determine:—

- (1) The area in which pain is felt and possible variations in the area under different conditions.
- (2) Its time relations. Is the pain constant or intermittent? Is it more frequent or more severe in certain conditions?

(3) The character of the pain.

(4) What factors modify the pain, increasing or reducing it, or alter its character.

Examination should naturally be first directed to find out:—

(1) Is there local disease of the painful area, or disease of an organ that commonly refers pain to it?

(2) Is the painful part fixed by reflex muscular spasms, or is the range of its movements restricted?

(3) Is there tenderness of the painful area to stimuli that normally do not cause pain, or is the reaction to pain-producing stimuli excessive?

(4) What is the state of cutaneous sensation over the painful area?

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REVISION CORNER

This section is devoted to short articles in which experts summarize modern treatment and clinical procedures, particularly for the benefit of general practitioners who have returned from the Forces.

THE SIGNIFICANCE OF ALBUMINURIA

It is still not commonly enough recognized that the simplest and quickest test for the presence of albumin in the urine is by the use of salicyl-sulphonic acid in the cold.

Take in each of two test tubes an equal amount of urine, conveniently to a depth of 1 inch, and add, to one tube only, 10 drops of 25 per cent. salicyl-sulphonic acid, and the occurrence of a haze or denser cloud in this tube compared with the control denotes the presence of protein. If the urine is absolutely clear a control need not be used.

On the other hand, the more commonly used boiling test requires care, especially when a patient has been taking potassium citrate or sodium bicarbonate in full doses. The safest procedure is to render the urine just acid *before* boiling by the addition of dilute acetic acid (5 per cent.), using a piece of litmus paper. This modification is necessary, because if a very alkaline urine is boiled the subsequent addition of acetic acid is not followed by the same degree of cloudiness.

INTERPRETATION OF ALBUMINURIA

The interpretation of albuminuria depends in the first place upon whether it is an accidental finding in a routine examination or whether it is obviously associated with renal or cardiac disease or with a febrile condition. In the former case the importance lies in the question whether the findings indicate the presence of organic disease or not. In tests of large numbers of apparently healthy individuals, albuminuria has been found in up to 5 per cent., and in a proportion of these, particularly in adolescents and young adults, such albuminuria does not signify any threat to the individual's health. These are the cases of so-called orthostatic albuminuria often associated with a degree of lordosis. Albumin appears in the urine of these individuals when standing, and diminishes in quantity or disappears completely when lying down. Frequently such cases first come to notice as a result of a life insurance examination. To demonstrate that such albuminuria is of this type requires two main criteria: first, that it occurs under the conditions just defined and, secondly, that there is complete absence of other pointers to the presence of renal disease, such as the occurrence of red cells or casts in the urine or of hypertension. The best way of getting an unequivocal answer to the question of the relation of the albuminuria to posture is as follows:—

Before going to bed at night the subject empties his bladder; waking at say, 7 a.m., he gets up and empties his bladder and immediately returns to bed and lies on his back with shoulders raised on two pillows and his knees raised. About one-and-a-half hours later he can get up and empty his bladder to produce a third specimen. He then carries on with his morning's tasks, remains standing or goes for a walk, and then produces a fourth specimen of urine. The four specimens so produced are tested using the same quantity of urine in each tube and using a standard amount of salicyl-sulphonic acid, say 10 drops. In a typical case of orthostatic albuminuria, specimens 1 and 4 will show an appreciable amount of albumin, specimen 2 a faint haze, and the third and most significant specimen will be albumin-free.

This test may seem unduly elaborate but it is very satisfactory. It must be stressed, however, that the diagnosis of orthostatic albuminuria must not be made lightly and without careful elimination of other obvious causes of proteinuria.

CLINICAL SIGNIFICANCE

Albuminuria occurs in a number of organic diseases, such as in the anæmias and in febrile conditions. Apart from scarlet fever, in which the occurrence of

albuminuria (and hæmaturia) denotes acute nephritis, the presence of albumin in the urine in other fevers is usually without significance. However, albuminuria not infrequently appears in tuberculosis, and this possible cause should always be borne in mind.

Acute nephritis is not now a common condition but as it can follow an acute streptococcal tonsillitis it is a wise precaution in such cases to test the urine again three to four weeks after the onset so that a symptomless nephritis should not be overlooked. In acute nephritis the degree of albuminuria (and hæmaturia) must be observed frequently, as its diminution is the best guide to the progress of the case. It is not essential to use Esbach's method of estimation as any rough method of grading the cloud of albumin, such as trace, +, or ++, is sufficient guide.

The greatest degree of albuminuria occurs in *subacute nephritis* (nephrotic form), and the protein loss which occurs this way is indeed the cause of the œdema. It is an indication for a full protein intake, not for its restriction.

In *diabetes with hypertension* the appearance of albuminuria denotes renal damage and a worsening of the prognosis.

In *congestive heart failure*, albumin is commonly found in the urine. It does not constitute any bar to the administration of mersalyl or other mercurial diuretics.

Finally, the necessity of routine and periodic testing of the urine throughout pregnancy should be stressed. Albuminuria occurring in the last three months of pregnancy denotes in general the existence of pregnancy toxæmia. It will as a rule be accompanied, preceded or followed by hypertension and œdema. But in any case the finding must be accepted seriously and the patient put to bed for investigation and treatment. Albuminuria occurring at an earlier date in pregnancy probably denotes an accompanying nephritis, and this is of grave significance for the life of the patient. In all cases in which albuminuria has been detected in pregnancy, whether or not eclampsia has been apparent, it is essential to observe if the albuminuria clears up completely or not. When it persists, nephritis has been established, either as a sequel of eclampsia or from further progress in the damage of a latent nephritis. In either case the prognosis is serious and contraindicates any further pregnancy.

HUGH GAINSBOROUGH, M.D., F.R.C.P.

ERYTHEMA NODOSUM

ERYTHEMA nodosum is characterized by a specific rash associated with constitutional symptoms occasionally accompanied by swelling of the joints.

ETIOLOGY

Erythema nodosum is not a disease entity. It was originally thought to be an acute specific disease, but it has been found in association with so many conditions that it is now regarded as an allergic response to a number of bacterial and other toxins. It occurs in association with tuberculosis, streptococcal infections, meningococcal septicæmia, coccidioidomycosis, sarcoidosis and other conditions, and as an allergic response to drugs, especially sulphathiazole and the heavy metals, gold, arsenic, and bismuth. In some cases the cause cannot be determined. On account of joint swellings it was at one time thought to be a manifestation of rheumatic fever, but these swellings are now considered to be allergic in origin, and the association with rheumatic fever, if it exists, is rare.

The majority of cases are associated with tuberculosis, almost always primary, but occasionally post-primary. The tuberculin test in the cases of primary tuberculosis is usually strongly positive, indicating a high degree of allergy to the infection. In half of these cases the X-ray of the chest reveals hilar and parenchymal lesions, frequently of the type described by some as epituberculosis. In others there are no radiological changes at the first examination, but calcification and other changes

appear subsequently. In a very occasional case the rash is associated with other potentially tuberculous manifestations, such as iritis or phlyctenular conjunctivitis.

The condition is most common between the ages of three and thirty-five, and is more frequent in females than males. Some say that it has a seasonal incidence, being more prevalent in the spring or autumn.

Several writers have described minor outbreaks in institutions, and these gave support to the idea that it was an acute infective disease. Further investigation, however, has usually revealed that the outbreak was due to a simultaneous exposure of several children to a case of open tuberculosis.

PATHOLOGY OF THE RASH

There is an intense inflammatory process involving the corium and deeper tissues, with capillary dilatation and exudation of serum, with red and white blood cells. There may be small capillary thromboses. In a few cases tubercle bacilli have been demonstrated in the nodules. The bruised appearance in the fading stage is due to the breakdown of red cells.

SIGNS AND SYMPTOMS

At the onset there are usually malaise, low-grade fever, general febrile aches and pains, anorexia, and sometimes sore throat. After a few days, or almost simultaneously with the onset of the fever, the rash appears, sometimes with swelling of the joints.

The rash consists of red or purplish, painful, tender shiny nodules or plaques, sparse or profuse, round or oval, measuring 4 to 150 mm. across, and sometimes coalescing. They are usually disposed symmetrically on the extensor surfaces of the legs, and in some cases on the thighs and extensor surfaces of the arms. They never ulcerate. Each nodule lasts for one or two weeks, and when it fades it may desquamate and show all the colour changes of a bruise. The total duration of the rash is from two to six weeks. The condition may recur, and it is said that recurrence is commoner in the non-tuberculous cases.

The associated *joint swelling* is not severe. Neither the redness nor the swelling is as intense as that of rheumatic fever, and the pain on movement is only slight. The joints involved in order of frequency are the knees, wrists, ankles, elbows, fingers, shoulders, toes and hips. The joint manifestations disappear when the rash fades, but reappear if there is a recurrence of the rash. Joint swellings occur with the same frequency in tuberculous and non-tuberculous cases.

INVESTIGATIONS

The urine and blood.—Examination of the urinary deposit by the Addis sediment count may show excess of red blood cells. The reason for this is unknown. There is usually a moderate polymorphonuclear leucocytosis and an increase of the erythrocyte sedimentation rate.

X-ray examination.—It is essential in all cases to perform a tuberculin test, and the chest should be X-rayed. Owing to the high degree of sensitivity to tuberculin shown in many of these cases, a very weak dilution should be used initially for the intradermal method (not stronger than 1 in 100,000), repeating with stronger dilutions if the first is negative; otherwise severe necrosis may occur at the site of the infection, with some danger of causing an exacerbation of the pulmonary lesion. The tuberculin jelly and Vollmer patch tests can be used with safety in these cases, for they do no harm in the hypersensitive subject. If the test is positive, the chest must be X-rayed, and if no evidence of tuberculosis is found the patients should be X-rayed again at intervals of approximately three months in order to detect possible later development and radiological evidence of tuberculosis.

In all cases of tuberculous origin thorough search must be made for the source of the infection, which is usually in the home or school.

DIFFERENTIAL DIAGNOSIS

The condition may be confused with *erythema induratum* (Bazin's disease). This is rarely found in children, is not associated with such marked constitutional symptoms, especially fever, and has an insidious onset. The lesions are found more on the flexor surface of the legs, are more chronic, and frequently ulcerate.

Erythema multiforme may cause some confusion when the rash is mainly nodular. Careful search may reveal other lesions—macules or vesicles—and lesions are often found on the face or in the mouth. Some Scandinavian authorities consider that the etiology is the same as that of *erythema nodosum*, and that there is the same frequency of association with primary tuberculosis in the two conditions.

Urticaria, bites, and syphilitic rashes may be confused by the inexperienced with *erythema nodosum*.

TREATMENT

The treatment is essentially the treatment of the underlying cause. It may be necessary to withdraw an offending drug. If the drug is sulphathiazole, it may be sufficient to substitute a different sulphonamide. The rash usually clears up promptly when the causative drug is withdrawn. If the cause is tuberculosis, this must be treated in the usual way. The patient need not be kept in bed after the acute stage unless there is joint swelling, or unless the causative condition demands it. Otherwise the treatment is that of any other febrile condition, with the addition of a local application, such as 5 to 10 per cent. ichthyol ointment or a lead and opium lotion.

PROFESSOR R. S. ILLINGWORTH, M.D., M.R.C.P., D.P.H., D.C.H.

NOTES AND QUERIES

Subscribers are invited to make use of the service provided in this section. Answers from experts will be obtained and dispatched as soon as possible to the senders of the queries. Publication of selected and suitable queries and replies is arranged according to available space.

The Causes and Prevention of Early Abortion

QUERY.—Three patients, aged twenty-one, twenty-six and thirty-six have had miscarriages at twelve weeks. "What is the reason and will it happen again?" they ask. What are modern theories of etiology and methods of treatment, clinical and preventative? How soon should a further pregnancy be advised? Which drugs are best in the acute stage and what investigations are necessary?

REPLY.—The question does not state how many children and miscarriages each of the patients has previously had. This is an important point because a woman should not be regarded as having a tendency to abort (habitual aborter), unless she has had at least *three consecutive abortions*. So numerous are the causes of abortion that the element of chance cannot be excluded if any lesser standard is accepted.

In considering etiology undue emphasis should not be laid upon modern theories. Many abortions are the result of causes long recognized, such as developmental errors in the fœtus, defects of embedding and of formation of placenta, general diseases (e.g. acute fevers,

syphilis, severe hypertension), or of pelvic pathology (e.g. uterine fibroids or retroversion) in the mother. Modern theories of etiology are attempts to break up the hitherto large class of unexplainable abortions. In the main they are hormonal, seminological and serological. Deficiency of progesterone secretion is commonly postulated, especially at the time of the change over in its secretion from that of the waning corpus luteum to its elaboration by the chorionic epithelium. Or it may be an imbalance between progesterone and the œstrogens. A high incidence of abnormal spermatozoa is found in the seminal fluid in some cases of habitual abortion. Genetic incompatibility between the maternal and paternal chromosomes, too, is postulated. These are all likely to result in early abortion. Rhesus incompatibility accounts for a number of late abortions, but not before the placenta is fully formed. Vitamin deficiency, particularly of vitamin E, has received considerable prominence.

Investigation should take the form of a careful and detailed history, a general physical examination including blood pressure readings, urine analysis, and a gentle but thorough pelvic examination. A blood Wassermann test and Rh

grouping of husband and wife should be done in the case of repeated abortion after the sixteenth week. Microscopic examinations of conceptional products may reveal unsuspected causes (e.g. areas of hydatidiform degeneration). Assay of hormones is not yet generally practicable.

As regards preventative treatment, various remedies have been used, particularly vitamin E, vitamin C, and progesterone. Cures are claimed. But there is an insufficiency of adequately controlled series of cases to allow of dogmatism about any of these remedies. Rest in bed at the time of the suppressed periods is harmless and possibly beneficial. Marital relations should be avoided. Drastic purgatives should not be taken. Vitamin E in capsules of 3 to 5 minims daily, continued up to full term, is probably worth giving. Progesterone 2 to 10 mgm. may be given three times weekly up to the sixteenth week. Alternatively, four pellets of 50 mgm. of progesterone may be implanted subcutaneously. This can only be of use in those cases in which there is a progesterone deficiency. Hence in the absence of pregnandiol estimations this expensive treatment is largely empirical.

There is no agreement about the methods to be used in treatment once the patient threatens to abort. Rest in bed (without bathroom privileges) for a full week after the bleeding has stopped is probably the most effective. Morphine or phenobarbitone are popular sedatives. Progesterone and vitamin E are largely used, quite empirically.

There is evidence to suggest that too early post-partum conception tends to be followed by a higher incidence of abortion. Therefore about six months should elapse before another pregnancy is begun.

A. W. PURDIE, M.B., F.R.F.P.S., M.R.C.O.G.

Intramuscular Paraldehyde

QUERY.—I understand that paraldehyde is sometimes given by intramuscular injection for the symptomatic treatment of convulsive states such as tetanus and infantile convulsions. How is paraldehyde sterilized? What dose is suitable (a) for infants, (b) for adults?

REPLY.—Since these injections are given, for the most part, in "emergency" conditions, it is quite common, if not usual, to inject the drug straight from the bottle, i.e., unsterilized. No harm appears to follow. If used systematically it is better to put it up in ampoules, which can then be sterilized in an autoclave, for its boiling point (123° to 126° C.) is well above that of water. Doses are roughly half the oral doses, say, 3 to 4 c.c.m. for an adult and $\frac{1}{2}$ to 1 c.c.m. for

a child of two years. In tetanus it may be necessary greatly to exceed these doses. There is a fairly wide latitude. The maximum response is usually obtained in fifteen to thirty minutes and a further dose may then be given, if necessary.

P. HAMILL, M.D., D.S.C., F.R.C.P.

Hodgkin's Disease

QUERY.—A female patient of mine, aged forty-two, was supposed to have splenic anaemia and consequently splenectomy was performed about six months ago. After splenectomy a diagnosis of Hodgkin's disease was made and confirmed. Deep X-ray therapy has given but little relief. Could anything be done for her to prolong her life?

REPLY.—If the diagnosis of Hodgkin's disease is correct the prognosis is very bad. Other organs in the abdomen are almost certainly infiltrated with the disease, and experience has shown that the duration of life is much shorter when the abdominal or bronchial glands are affected than when the disease is confined to a local collection of the glands in the neck. A further indication of the poor outlook is the failure of X-ray therapy to give relief. There is no known curative agent for Hodgkin's disease, and treatment accordingly must be along symptomatic lines for anaemia.

PROFESSOR L. S. P. DAVIDSON, M.D., F.R.C.P.ED.

Thyroid Enlargement during Pregnancy

QUERY.—In the issue of *The Practitioner* for October, 1946, Dr. Gardiner-Hill states that simple thyroid enlargement which may occur during pregnancy must be treated with iodine. My wife developed such thyroid enlargement during pregnancy; this has produced no symptoms. My child, who is now nine months old, was breast fed without any difficulty on the part of my wife. Would you please advise me whether I should give my wife iodine, and if so, in what doses?

REPLY.—The thyroid enlargement developing during pregnancy was no doubt a simple compensatory hypertrophy for a relative iodine deficiency. The condition is common at these times and is an indication for iodine treatment; say Lugol's iodine solution, 5 minims daily for the rest of the pregnancy. It is very unlikely that iodine given now will produce any diminution in the size of the gland, as it has already been through one cycle. It is important, however, to give a course of iodine from time to time to prevent any further hypertrophy. As good a plan as any is to take 5 minims of Lugol's

solution daily for six weeks to two months, two or three times a year. In the event of a further pregnancy, it would also be advisable to take iodine during the pregnancy, in dosage as above, to avoid a further hypertrophy and hyperplasia.

H. GARDINER-HILL, M.D., F.R.C.P.

Thyroid Administration

QUERY.—It is customary to give thyroid in divided doses during the day. Is there any justification for this procedure, in view of the fact that thyroid administration only takes effect after several days?

REPLY.—I do not think there is any good reason for giving thyroid extract in divided doses during the day; it will be just as effective if given in one single dose.

HAROLD COOKSON, M.D., F.R.C.P.

Corneal Cloudiness after Trachoma

QUERY.—Could you kindly inform me if there is any form of treatment likely to improve the vision of one of my patients suffering from a uniform cloudiness of the cornea as a result of trachoma of twelve years' duration? His trachoma has been successfully treated with silver nitrate and copper sulphate and there is no apparent infection of the conjunctiva. Slight pannus is still present in both eyes. He is able to count fingers at 2 ft.; W.R. negative and no history of exposure. Duration of complaint six months. Treatment in the form of subconjunctival saline, dionine 2 per cent. drops and yellow oxide of mercury 1 per cent., has proved ineffective.

REPLY.—A distinction must be drawn between the visual defect due to opacity of the cornea and that due to irregular astigmatism as a result of corneal scarring. Local application of drops or lotions is unlikely to assist the former type of incapacity, though some spontaneous improvement may be expected to occur up to two years after the cessation of active disease. Ascorbic acid in 50 mgm. doses three times daily may help in this process, and injections of contramine 0.025 gm. to 0.125 gm. are reputed to assist clearing of the cornea. The use of

sulphonamides by mouth might be considered if there is any doubt of the persistence of active trachoma. The latter type of visual defect sometimes receives great benefit from the use of contact lenses, if they are available. The onset of "cloudiness of the cornea" after eleven-and-a-half years of active trachoma when that condition has almost become quiescent induces the query whether the "cloudiness" is due to the trachoma or to some other cause such as corneal dystrophy. Corneal opacity due to scarring, when vision is counting fingers at 2 feet in both eyes, not improved by contact lenses, and when the eyes are otherwise healthy, is a possible indication for surgical treatment by a corneal graft.

A. G. CROSS, F.R.C.S.

Blushing in a Young Male Adult

QUERY.—A young intelligent patient of mine in a responsible position is suffering from anxiety neurosis. He blushes severely on the slightest provocation, this being the expression of his social conflict. Is there any way in which he can be released from this distressing symptom?

REPLY.—If blushing is this patient's only symptom it should be relatively easy to help him to overcome his trouble. Although you say "on the slightest provocation" it will probably be noted that there are situations in which the symptom does not occur. How do these differ from others? The reaction is usually associated with a feeling of shame. The patient may feel that shame is irrational. Its persistence is because his attitude to adult activities is still fettered by less mature loyalties, i.e., to the ideals which he has imagined parents or school tradition have imposed. Or it may not be social shame so much as personal shame that he has failed or is about to fail to live up to his own over-high standards. These traditions may well extend in other directions which he will admit, although he is at present unconscious of them in the blushing situations.

A psychiatrist might be consulted in order to illuminate the problem. He might well be asked to give help as to how to continue helping your patient after an initial interview with him.

HENRY WILSON, M.D., F.R.C.P.

PRACTICAL NOTES

The Treatment of Liver Sensitivity

ACCORDING to S. O. Schwartz and H. Legere (*Blood*, July 1946, I, 307), sensitivity to liver extract is not so uncommon as is generally believed. During the period 1940-45, they found such sensitivity in 68 out of 396 out-patients (17 per cent.) who were being given

parenteral liver extracts for the treatment of pernicious anaemia. On the other hand, a search of the literature revealed only one report of a fatal reaction. For the treatment of such sensitivity they recommend four procedures. Changing the brand of liver extract may prove successful. If this fails, then smaller doses

ould be used. Thus, if the usual dose is c.cm. of liver extract every two to three weeks, then a dose of 1 c.cm. should be given weekly and increased by 0.5 c.cm. per injection until the patient is again receiving 3 c.cm. Should the patient be sensitive to 1 c.cm., then an attempt at desensitization should be made by giving an injection of 0.1 c.cm. and increasing this by 0.1 c.cm. per week until the patient is having 1 c.cm. weekly. Subsequently the dose can be increased by 0.2 c.cm. per week until the full dose is again being given. All but eleven patients in this series responded to one or other of these forms of treatment. These 11 patients were treated by means of "antigen H", which is para-amino-benzoyl histamine coupled with a protein. The antibody formed as a result of the injection of this substance is presumed to act as a neutralizer to the histamine or "H" substance released by the tissues in response to sensitizing substances. The initial dose of "antigen H" is 0.1 c.cm., given subcutaneously, and at the same time the maximal tolerated dose of liver extract is given intramuscularly. The dose of "antigen H" is increased each week by 0.1 c.cm. until a total of 1 c.cm. is being given. The dose of liver extract is increased concurrently. This therapy proved successful in ten out of eleven patients. It is pointed out that the immediate treatment of a reaction is to give 1:1000 adrenaline in doses of 0.5 to 1 c.cm. subcutaneously, and it is emphasized that such a solution should always be available for use when an injection of liver extract is being given.

Radon Ointment in the Treatment of Late Irradiation Ulcers

Using a radon-lanolin ointment containing 200 electrostatic units per c.cm., D. Kirsh *et al.* (*American Journal of Medical Sciences*, October 1946, 212, 395) report satisfactory results in the treatment of late irradiation ulcers. The ulcer must be thoroughly cleansed, débrided and dried before the ointment is applied. If there is much slough or necrotic tissue the preliminary application for some days of zinc peroxide, or sulphanilamide-allantoin ointment, is recommended. The radon ointment is applied with a wooden tongue blade to the entire lesion and a periphery of sound tissue, in a thickness of about 1 mm., 1 c.cm. covering approximately 10 sq. cm. of the lesion. The ointment must be covered with an air-tight dressing, and for this a rubber dam, oil silk, or cellophane fastened down with overlapping adhesive tape is recommended. The ointment is applied for eight hours once a week, but if the response is slow the period of application may be increased up to twenty-four hours once a week. When the

dressing is removed the underlying area is cleansed, and a bland ointment, e.g. boracic acid ointment, or a bactericidal preparation is applied. Irritative medications and prolonged exposure to sunlight are forbidden. Care must be taken to prevent the ointment from coming in contact with the physician's hands or with a larger area of the patient's skin than is necessary. When not in use the ointment should be stored under lead protection. Of 19 late irradiation ulcers in 17 patients treated in this way, 12 healed completely with from three to fifty weekly applications, 2 showed a good response but failed to heal completely, and 5 showed little or no response. It is clear that this treatment should only be carried out under the supervision of a physician or surgeon experienced in the use of radio-active substances.

Traumatic Marginal Alopecia

This is a condition almost entirely confined to negro and mulatto women. A full description of it is given by O. G. Costa (*British Journal of Dermatology and Syphilis*, November-December 1946, 58, 380). It is the result of the habit of negro women who, in an attempt to do up their hair like white women, stretch their hair and try to keep it in its forced position by means of hairpins and hair combs. The area of alopecia is usually triangular in shape and affects the hairy scalp in front of, and a little above, the ear. Sometimes it is prolonged into the occipital region or the frontal region; more rarely it may involve the whole periphery of the hairy scalp. The alopecia is due to each hair, on reaching a certain length, being pulled out in the act of combing or after being stretched for a few days. If the traction is maintained for a sufficient length of time permanent alopecia develops as a result of sclerosis or atrophy of the hair follicles, but if the traction ceases after a fairly short period the condition disappears. Although relatively rare among white women, Costa states that he has observed many cases, "especially with the use of the new methods of hair-dressing". The age at which it occurs depends upon the age at which the woman starts to apply traction to her hair.

Valine in the Treatment of Non-Infected Wounds

PROMISING results have been reported by R. Bariatti (*Minerva Medica*, 1946, 39, 273) from the use of valine (amino-valerianic acid) alone or together with sulphonamides in the treatment of infected or non-infected wounds. Reports of two cases only are given in the paper, but results of other workers are quoted. Thus Rossi, Ciocca and Soresi (*Bull. Ist. Sieroter.*

Mil., 1944) are quoted to have obtained good results from local application of valine in infected wounds, burns, varicose ulcers, boils and empyema. In all these cases the drug was used in conjunction with surgical treatment. The action of valine seems to be twofold: a cleansing action on the infected wounds, resulting in the quick elimination of necrotic tissue, and a stimulating action on the epithelial and connective tissues which speeds up the healing of the wounds. Bariatti has used valine (10 gm. daily, in five doses by mouth) together with sulphathiazole (3 gm. daily) in two cases of chronic actinomycosis and streptococcal infection resistant to other treatment. Beneficial results were evident within ten days. Clean surgical wounds are said to heal quickly after local application of valine. The substance is well tolerated, both in local application and by mouth. Both the cleansing action and the stimulation of the regeneration of epithelial and connective tissues are of interest, and not only from the practical point of view; it is possible that the similar actions of tissue extracts and red cells powder (reported by various other workers) may be due to some similar basic mechanism.

The Psychoneuromuscular Control of Enuresis

In a letter discussing the psychological treatment of enuresis, E. E. Ziegler (*Journal of the American Medical Association*, November 30, 1946, 132, 809) recommends a psychoneuromuscular exercise which has been stated to cure enuresis in one to two weeks. The child (or adult) is instructed to stop and start the flow of urine two or three times during each daytime micturition. The procedure exercises the psychoneuromuscular mechanism, and by helping to establish the dominance of the higher psychic centres over the purely reflex neuromuscular mechanism, the cerebral dominance soon passes over into the unconscious period of sleep. The procedure is suitable for all over the age of six and in some cases may be used in younger children. With small children it is well for a parent to stand by during the daytime micturition and to coach the child in the exercise of stopping and starting the flow of urine. The case of a woman of twenty who had several times postponed marriage on account of enuresis, and who rapidly cured herself with the recommended exercise, is recorded.

Absorption of Ammonium Chloride

ON account of its tendency to produce gastric irritation, ammonium chloride is frequently prescribed in enteric-coated tablets. F. L. Selye (*Canadian Medical Association Journal*,

November 1946, 55, 445) has come to the conclusion that in a small percentage of cases su tablets pass unchanged through the gastric intestinal tract, whilst in a rather larger number of individuals no acidosis follows their prolonged administration, even though the tablets are destroyed before excretion. This latter finding explained on the basis that destruction of the tablets does not occur until they have reached the level of the intestinal tract which is too low for absorption to take place. The evidence upon which these findings are based consisted of a radiological demonstration of the intact tablet in the lower colon and of no appreciable change in the CO_2 combining power of the blood following the ingestion of comparatively large doses of ammonium chloride, e.g. 6 to 8 gm. daily. On the other hand, satisfactory absorption was noted in 60 patients with gelatin-coated tablets, and in only two of these was there any evidence of gastric discomfort.

Promin in the Treatment of Leprosy

A REPORT of the results obtained in seven cases of advanced leprosy treated for one year by intravenous administration of promin is given by L. H. Wharton (*Leprosy Review*, October 1946, 17, 96). All the patients belonged to the twenty to thirty year age group; three were men and four women. All were suffering from serious complications of the disease, and two were practically blind. Before beginning treatment complete blood counts and urine analyses were carried out, and repeated every two weeks during the year's course of treatment. Promin was given intravenously, in dosage of 2 gm. daily for the first six days, then one day's rest and then a gradual increase by 1 gm. weekly until a maximum dosage of 5 gm. was reached. The drug was then continued in dosage of 5 gm. daily throughout the year, with one week's rest at the end of each six weeks of treatment. After one month's treatment a marked improvement in the physical and mental conditions of the patients was noted, appetites improved, the patients began to take interest in themselves and their surroundings, and the ulcers were all clean. After three months' treatment chronic ulcers were showing rapid signs of healing, oedema of the face and legs had subsided, and the patients were gradually assuming a normal appearance. The eye conditions had not progressed, rhinitis had subsided, and nasal ulcers were healing. After six weeks' treatment the chronic ulcers had healed completely (it is pointed out that these ulcers had failed to respond to all forms of treatment for many years), the nasal ulcers had healed, nodules were flattening out, and in the eye cases, although there was no marked improvement in vision, the condition had not

worsened. At the end of the second six months' treatment the improvement continued, no relapses had occurred, and there were no signs of drug intoxication. The treatment is to be continued for another year.

Keeping Properties of Nitroglycerin Tablets

NITROGLYCERIN is so commonly used in the treatment of angina pectoris, and opinion is so divided as to its keeping properties, that E. L. Sagall *et al.* (*New England Journal of Medicine*, October 31, 1946, 235, 650) decided to investigate the problem. Soluble hypodermic tablets were used for the purpose, as they were considered to be more satisfactory than triturated ones for the treatment of angina pectoris on account of their rapidly dissolving properties. The strength of tablet ranged from 1/100 grain (0.6 mgm.) to 1/500 grain (0.1 mgm.). Fifteen different preparations were tested: three were fresh tablets (less than two months old); three had been on the laboratory shelves in pasteboard pillboxes for three to five years; five were obtained from the shelves of druggists where they had remained for four to eleven years; three were kept in pasteboard boxes in an incubator at 37° C. for three months; one had been kept in a loosely fitting screw-cap vial and carried by a patient for four months close to the body in the same trouser pocket used for carrying his clinical supply of nitroglycerin. The criterion of efficacy was the effect of the tablets upon the exercise tolerance test in patients with angina pectoris whose reaction to this test had been well standardized. The clinical effectiveness of all the tablets was satisfactory, with the exception of those that had been exposed to heat. These last showed complete loss of clinical potency. These results indicate that under ordinary conditions of storage, tablets of nitroglycerin retain their effectiveness for many years, whilst under ordinary conditions of use by patients they remain effective for at least four months. The loss of potency on exposure to heat, however, suggests that storage near hot pipes or radiators may cause deterioration.

Penicillin and Local Anæsthesia

In a preliminary report, V. J. Reynolds (*American Journal of Obstetrics and Gynecology*, October 1946, 52, 641) gives reasons for believing that the addition of penicillin to a local anæsthetic is of value in reducing the incidence of infection in repairs of incisions and lacerations of the vulvo-vagino-perineal areas sustained during parturition. The anæsthetic used was 1 per cent. procaine hydrochloride in normal saline, to each c.cm. of

which 250 units of sodium penicillin were added. A fresh solution of penicillin and procaine was made at the time of each delivery, and an average of 45 c.cm. was injected at each operation. In 81 consecutive cases the results of the repair were considered excellent in 77; three were excellent except for 1 cm. shallow separations of the skin at the distal angle, whilst in one case a large submucosal hæmatoma developed in the episiotomy area, but no evidence of infection was detected. About 50 per cent. of the patients complained of some discomfort at the time of injection. When seen twelve weeks later, the areas involved were considered to show less scar tissue, less tenderness and more normal elastic properties than the control series. The control series consisted of 169 consecutive cases, and among these there were seven "unsatisfactory" and twenty "disturbing" results. It is suggested that further investigation should be carried out to determine the optimum dosage of penicillin per c.cm. of local anæsthetic. The addition of penicillin to the local anæsthetics used for major and minor vaginal surgery is anticipated.

Penicillin Chewing Gum

A COMMUNICATION from the Kent and Sussex Hospital, Tunbridge Wells (*Pharmaceutical Journal*, December 7, 1946, 157, 354) describes the successful use of penicillin chewing gum in the treatment of Vincent's infection, streptococcal tonsillitis, subacute laryngitis, pharyngitis, and as a post-operative routine after removal of septic tonsils. The method of preparation was as follows:—

A mass of chewing gum sufficient for cutting into 20 pieces is warmed in an enamel dish on a water-bath. The gum becomes soft at about 40° C. It is placed in a sterile mortar and 200,000 units of dry calcium penicillin powder are added and rubbed in with a pestle. When thoroughly mixed the mass is transferred to a pill machine, rolled as for 20 pills, and then cut into 20 pieces with the cutter.

Tests carried out with chewing pellets containing 10,000 units of calcium penicillin and 10,000 units of sodium penicillin showed that after seven hours' chewing, penicillin activity was well maintained in the calcium-penicillin pellets: the amount present in the saliva after half-an-hour's chewing gave a 48 mm. zone of inhibition, 36 mm. after one hour, and then 34, 32, 29 and 26 mm. at hourly intervals, down to a zone of 21 mm. after seven hours' chewing. The results with the sodium penicillin pellets were not so good: after half-an-hour's chewing the content in the saliva gave a zone of only 27 mm. inhibition, and after four hours' chewing 13 mm.; thereafter no penicillin was present in the saliva. The method of dosage adopted at the Kent and Sussex Hospital is to give the patient three pieces of gum, with instructions to chew each piece for four hours,

REVIEWS OF BOOKS

Skin Diseases: Nutrition and Metabolism.

By ERICH URBACH, M.D., F.A.C.P. London: William Heinemann (Medical Books) Ltd., 1946. Pp. xxii and 634. Illustrations 266. Price 50s.

THIS comprehensive work is a welcome sign of the growing tendency towards the integration of dermatology and general medicine. Both dermatologists and physicians have been to blame for the present regrettable state of affairs, in which dermatology consists largely of brilliant descriptions of diseases which are treated mainly on an empirical and local basis. The process of integration, whereby the skin is looked upon merely as one of the many parts of the body which may be involved in disturbances of the organism, is of very recent origin. In this work an attempt has been made to deal with one aspect of the problem, namely, the influence of nutrition upon the skin. The subject is covered in four main sections: the influence of nutrition on the physiology of the skin; nutritional causes of dermatoses; influence of diseases of the gastro-intestinal tract, liver, and pancreas on the skin; and nutritional therapy of skin diseases. Of the comprehensiveness of the book there can be no question: 1,320 references, 266 illustrations and 112 tables. Unfortunately, the process of selection and discrimination is not of the same standard, with the result that the reader is presented with a mass of contradictory statements that is all too liable to lead to confusion. Had the author been prepared to present a judicious summing up of the many facts provided, the book would have proved of much more value to both dermatologists and general physicians. As it stands, it may well serve as a useful reference book to all who are interested in this particular aspect of dermatology.

Eye Surgery. By H. B. STALLARD, M.B.E., M.D., F.R.C.S. Bristol: John Wright & Sons Ltd., 1946. Pp. ix and 444. Figures 338. Price 50s.

EYE surgery cannot be learnt from a textbook, but this volume is likely to prove of the greatest assistance to students of ophthalmology and, as a book of reference, to any member of the staff of an operating theatre which has to deal with ophthalmic patients. Every aspect of the subject is covered, beginning with the essentials of theatre organization and anaesthesia for ophthalmic operations, and going on to the surgical procedures applicable to the various parts of the eye and its annexa. The plastic surgery of the lids is well described with

attention to practical detail, but without complex descriptions of the many alternative operations, and there is a most useful chapter on traumatic surgery. This book does not pretend to cover the whole field of ophthalmic surgery but it gives a careful account of the standard operative procedures practised in this country at the present time. It is clearly illustrated and is a valuable addition to standard ophthalmic literature.

Principles of Anatomy and Physiology for Physical Training Instructors in the Royal Air Force 1946. London: H.M. Stationery Office. Pp. 175. Price 7s. 6d.

THE first 90 pages are devoted to the anatomy of the body framework, joints and muscles. This section is illustrated by 100 diagrams, most of which are coloured. The text is admirably clear and is presented in the least academic manner possible. The physiology has been compressed into 10 pages and has suffered accordingly but, apart from some obvious exceptions, is reasonably adequate. The section devoted to renal function needs rewriting; the oxygen percentage in the blood does not decrease as one rises above sea level and endocrine function is not an answer to the question "Why do individuals vary in their capacity to benefit from exercise?" The remainder of the book is taken up by posture and corrective exercises, breathing, fitness for flying, general fitness, the instructor's part in rehabilitation, and answers to some commonly asked questions. The same clarity which characterized the first section in text and diagrams predominates. This manual is distinguished by its context, production and cost.

Vitamins; Hormones; Ferments. By ABDERHALDEN. Basle: Benno Schwabe & Co., 1946. Pp. 250. Price Sw. frs. 14.50.

THIS book can be said to contain within its relatively small compass all the information necessary to medical practitioners or students, on vitamins, hormones and enzymes. A short introductory chapter shows the close connexion that has now been proved to exist between the vitamins, hormones and enzymes, the body dependence upon them and their interdependence upon each other. The second section of each chapter deals with the physiologic properties of the substance, and the third with biological and chemical methods of assay and the units of standardization. In the vitamin chapters a short section is devoted to the principal foodstuffs in which the particular vitamin is found. Next comes a short section on

the clinical applications of the compound, and finally a list of proprietary preparations (all of continental origin). The book is written in a manner sufficiently non-technical to demand no highly specialized knowledge of chemistry. The information in such a book, covering so wide a field in so small a compass, is necessarily in a very condensed form and the book contains a number of generalizations which are misleading. In the last paragraph on page 97, for instance, a general distinction is made between the hormones of a protein nature, which are therefore inactive by mouth, and the other hormones "which are very stable bodies, not attacked by digestive enzymes and so can be administered orally". This is actually not true of the steroid hormones, which are almost inactive by mouth and are always given by injection. It is regrettable that the "Abwehr-ermemente" doctrine is kept alive, presumably for family reasons. It is unfortunate that the book contains no references at all to original papers.

On the Contribution of Clinical Study to the Physiology of the Cerebral Motor Cortex. BY F. M. R. WALSH, M.D., D.Sc., F.R.C.P., F.R.S. Edinburgh: E. & S. Livingstone Ltd., 1947. Pp. 31. Price 1s. 6d.

THIS, the Victor Horsley Memorial Lecture, 1946, is a brilliant defence of "the authentic method of science, philosophically considered, with its observational and conceptual elements". At the same time it provides a penetrating analysis of modern views on the cerebral cortex. Written with that lucidity, ruthless logic and passionate love of truth that characterize all the author's writings, it is a notable addition to the many clinical contributions of English physicians to the art of neurology. Incidentally, is it a sign of better things to come that a lecture delivered in November 1946 should have been published in book form before the end of 1946?

Spanish-English Medical Dictionary. Compiled by MAURICE McELLIGOTT, F.R.C.S., D.P.H. London: H. K. Lewis & Co., Ltd., 1946. Pp. 250. Price 12s. 6d.

IN compiling this useful dictionary of medico-surgical terms the author has had, among other helpers, the assistance of J. Trueta, the eminent Spanish surgeon. The work will be warmly welcomed by medical translators, to whom the correct English equivalents of 14,000 Spanish medical terms will prove of great assistance. Good dictionaries of foreign medical terms are rare nowadays, and the author is to be congratulated on his achievement.

NEW EDITIONS

Textbook of Medicine, edited by SIR JOHN CONYBEARE, K.B.E., M.C., D.M., F.R.C.P., in its eighth edition (E. & S. Livingstone Ltd., 30s.) appears only eighteen months after the previous edition, but a new section has been added on penicillin; also a useful appendix on aviation medicine, and a new article on the menopause. This well-known textbook does not call for any detailed criticism but the new edition will be found up to date in all sections.

THE fifth edition of *Diseases of Infancy and Childhood*, by WILFRED SHELDON, M.D., F.R.C.P. (J. & A. Churchill Ltd., 30s.) contains, among other new material, sections on the tuberculin jelly test, the cellophane swab for oxyuris, the serum treatment of influenzal meningitis and, of course, wide reference to the use of penicillin. The new edition is well illustrated with 143 text figures and 18 plates.

AMONG the new additions to *Aids to Medical Diagnosis*, by G. E. F. SUTTON, M.C., M.D., M.R.C.P., in its sixth edition (Baillière, Tindall and Cox, 6s.) is a chapter on the electro-encephalogram. This is the first edition of the work not to be revised by the original author, the late Dr. A. J. Whiting. A very complete revision has been undertaken and the book has been brought up to date in all sections.

A Guide for the Tuberculous Patient, by G. S. ERWIN, M.D., in its second edition (William Heinemann (Medical Books) Ltd., 3s. 6d.) contains three new sections, on nerves, social statistics and aviation. This useful little book deals with all aspects of the problems of tuberculosis, and chiefly from the patient's point of view.

PENICILLIN looms large among the advances in medicine and surgery included in the sixty-fourth edition of *The Medical Annual*, 1946 (John Wright & Sons, 25s.): a complete review of penicillin is given by J. S. Jeffrey, a section on dosage in infancy is contributed by R. Miller, and a welcome section from the pen of the late Tudor Edwards deals with the use of penicillin in chest surgery. The insecticide D.D.T. and the use of atabrin in malaria are other points of interest, but streptomycin is only included in relation to typhoid fever, and there is some irony in the fact that the immediately preceding section on tularemia records the fact of the increase in the incidence of this disease but no mention is made of streptomycin therapy, which has been found 100 per cent. successful. No doubt the new edition was compiled before this welcome fact became general knowledge.

NOTES AND PREPARATIONS

PREPARATIONS

RUTIN A & H.—Rutin, a flavonal glycoside isolated from the flowers and leaves of buckwheat, has been used in the treatment of increased capillary fragility associated with hypertension. Rutin tablets A & H, each containing 20 mgm. of the drug, are issued in bottles of 100 by the manufacturers, Allen and Hanburys Ltd., Bethnal Green, London, E.2.

✓ **'INTRAVAL SODIUM'** brand SOLUBLE THIOPENTONE is a mixture of 100 parts by weight of sodium ethyl (1-methyl butyl) thiobarbiturate and 6 parts by weight of exsiccated sodium carbonate. It has been prepared for intravenous administration, either alone or with nitrous oxide and oxygen; for induction followed by inhalation or a local or spinal agent; for the control of anaesthetic convulsions, and in cases of tetanus and status epilepticus. 'Intraval Sodium' is supplied in dry ampoules, with ampoules of distilled water, by May & Baker Ltd., Dagenham, Essex, from whom a descriptive booklet can be obtained.

FELLOW'S SYRUP is again available in limited quantities, and samples can be obtained from Fellow's Medical Manufacturing Co. Ltd., 286 St. Paul Street, W., Montreal, Canada.

THE TWELFTH CONGRESS OF THE INTERNATIONAL SOCIETY OF SURGERY

THE twelfth Congress of the International Society of Surgery will be held in London from September 14-20, 1947. Dr. Leopold Mayer of Brussels will be President and among those reading papers will be Sir Alexander Fleming, Professor Blalock and Professor R. Leriche. Professor G. Grey Turner is Chairman of the British Committee, and a programme of entertainment will be arranged for those attending the Congress. For further particulars application should be made to the Hon. Secretary, Mr. H. W. S. Wright, M.S., F.R.C.S., 9 Weymouth Street, London, W.1.

BRITISH EMPIRE CANCER CAMPAIGN

THE twenty-third Annual Report, 1946, covers a wide field, including research, x-ray therapy, radiation and surgery. It is welcome news that the Campaign has undertaken the production of the *British Journal of Cancer* as its official organ. The journal will be published quarterly by H. K. Lewis & Co. Ltd., at an annual fee of 42s., and it is hoped that the first issue will appear in March. The registered offices of the British Empire Cancer Campaign are at 11 Grosvenor Crescent, London, S.W.1.

BRITISH COUNCIL FOR SPASTIC PARALYSIS

A BRITISH Council for the welfare of the suffering from spastic paralysis was constituted on December 12, 1946, under the Chairmanship of Professor J. M. Mackintosh, Dean of the London School of Hygiene. The Council will act as a central advisory and consultative body for all activities in Great Britain and Northern Ireland.

NEW PUBLICATIONS

Your Guide to the National Health Service, by A. DAVID LE VAY, M.S., F.R.C.S. (Hamish Hamilton Medical Books, 3s. 6d.) discusses the National Health Services from the point of view of the doctor, the patient, hospitals and health workers. The author has admirably summarized a vast subject and has presented it in a manner easily understandable by all and sundry. *The Journal of General Microbiology* made its first appearance in January, 1947. The Chief Editors are DR. B. C. J. G. KNIGHT and DR. A. A. MILES, supported by seven Associate Editors, and the object of the journal, which is published by the University Press, Bentley House, 200 Euston Road, London, N.W.1, is to present original research work and thereby to promote the advancement of microbiology.

J. & A. CHURCHILL, LTD.

AFTER fifty years devoted to the advancement of medical publishing, Mr. A. W. Churchill is retiring from the position of Managing Director of J. & A. Churchill Ltd. He will, however, remain on the Board as Vice-Chairman, so his connexion with the business, which was founded by his grandfather in 1825, will not be severed. The new Managing Director will be Mr. J. Rivers, who has been connected with the firm for forty years, and Mr. J. A. Gibson, the Secretary, has also been appointed to the Board.

OFFICIAL NOTICES

The Preservation of Proteins by Drying (Med. Res. Coun. Spec. Rep. Ser. No. 258), by R. I. N. GREAVES, which deals in particular with the production of dried human serum and plasma for transfusion, is published by H.M. Stationery Office, price 2s. *Memo 146/T. Revised 1946*, gives the arrangements with the Ministry of Pensions for the provision, in respect of ex-Service and other war disabled pensioners, of residential treatment and other services for tuberculosis in England.

The contents for the March issue, which will contain a symposium on "Physiotherapy in General Practice", will be found on page lxxiv at the end of the advertisement section.

THE PRACTITIONER

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COUNTER-IRRITATION

By W. H. WYNN, M.D., M.Sc., F.R.C.P.

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University of Birmingham.*

COUNTER-IRRITATION, with its source in demonism and magic, is the oldest known method of treatment. In the Ebers Papyrus (compiled about 1550 B.C.) the cautery is mentioned and prescriptions are given for poultices and plasters. The ancient Chinese used acupuncture, and in place of the cautery employed the "moxa"; one or more small cones of the downy leaves of an artemisia were placed on the skin over the affected part and ignited. Moxa was introduced into Europe by the Dutch and Portuguese. Sydenham used it for gout, and moxibustion is still in vogue in Japan, as we read in John Hersey's remarkable book "Hiroshima". The first use of leeches is attributed to Themison of Laodicea (123 B.C.), and leeching reached its zenith with Broussais (1772-1838), who applied up to 50 leeches on a patient. So much did it become the fashion that in 1833 it is said that 41,500,000 leeches were imported into France. We do not know when blisters were first used but the Spanish fly was known to Galen. In Osler's textbook of medicine (1938) occurs the following passage:—

"For lumbago acupuncture is, in acute cases, an efficient treatment. Needles of from 3 to 4 inches in length, ordinary bonnet needles sterilized will do, are thrust into the lumbar muscles at the seat of the pain and withdrawn after 5 to 10 minutes. In many cases the cautery gives relief and in obstinate cases blisters may be tried."

A persistence through 3,500 years from the time of King Re-Ser-Ka to Osler is impressive, and a treatment, however empirical, which has been practised through the ages cannot lightly be dismissed. Forty years ago it was not uncommon to see patients with the marks of acupuncture, the cautery, or cupping, and limbs or chests covered with pustules from the application of croton oil or mustard. In this age of scientific medicine, counter-irritation, at any rate in its cruder forms, has fallen into disuse, partly because of the difficulty in giving a rational explanation of its action but also because the older methods are being replaced by various forms of electrotherapy. Attempts at rationalization, whether by the Arabian theory of revulsion, the Hippocratic derivation, or the methodism of Asclepiades, have long been abandoned, as also the vague notion that counter-irritation would draw out evil humours.

An attempt to give counter-irritation a scientific basis is at once faced

with considerable gaps in our basic knowledge, the lack of critical and controlled experiments, and the uncertain psychological factors of expectation and suggestion.

THE EFFECTS OF COUNTER-IRRITATION

From the work of Thomas Lewis (1927) and others we know what happens when the skin is irritated. Whatever the method—firm stroking, heat, acupuncture, mustard gas, infra-red or ultra-violet rays—all fundamentally produce the same set of phenomena. A redness of the skin localized to the area irritated appears, after a latent period varying with the method adopted, due to dilatation of superficial capillaries. Later, a surrounding spreading flare appears, caused by dilatation of arterioles conditioned by an axon reflex. This is followed by exudation into the tissue spaces, producing a wheal or local œdema which may go on to a blister. This triple response is due to a chemical substance set free from the damaged cells. As an injection of histamine into the skin produces exactly the same effects it is assumed that the released substance is either histamine or a closely allied body.

Much less is known of what occurs in the deeper tissues beneath the irritated skin. Much probably depends upon the nature of the irritant, its intensity and area of application. Heat appears to be the most effective method of producing deep-seated effects. Reddening of the skin of the hand by heat will cause increased pulsation in the digital arteries and increased size of the veins on the back of the hand. Applied to the temple or scalp, the temporal artery, previously inconspicuous, will become prominent and tortuous. Heat therefore dilates the deeper blood vessels as well as those of the skin and causes an increased flow of blood through subcutaneous tissues and muscles. This is due to a central nervous reflex. The deeper tissues may, of course, be directly heated by the galvanic current, diathermy, or short wave therapy, with a similar result. There are also more remote effects. If the legs are placed in hot water there is an increased flow of blood through the arms, or if the left arm is heated the vessels of the right arm will also dilate. The application of heat in any form will raise the temperature of the whole body, unless there is a counterbalancing loss of heat from other areas, and the general metabolism will be stimulated. Other forms of irritation, such as a blister, may give rise to the sensation of heat from the flow of warmer blood from deeper parts to the surface, but the body will not gain heat.

We have no exact knowledge of the action on the deeper circulation of such substances as blisters, mustard, or histamine, the superficial actions of which resemble that of heat. Heat is usually applied over a much larger area, and it is possible that if other counter-irritants could be applied at a suitable intensity over a large surface the result might be similar. Leeches differ from other counter-irritants in that the skin response is minimal. A leech removes from 4 to 8 c.cm. of blood, and a further 15 to 20 c.cm. may

be lost if a hot fomentation is applied after the leech is removed. The quantity of blood is not great but, if it is drawn from a neighbouring and limited area having the same blood supply as the skin and no arterial dilatation occurs, it is possible that a deeper organ may be depleted by the blood drawn from the surface. This may be a true example of the old theory of derivation.

REFERRED PAIN AND COUNTER-IRRITATION

The theory of referred pain has been used in the attempt to explain counter-irritation. It is known that a visceral or deep-seated somatic lesion may give rise to pain which is referred to the skin innervated from the same spinal segment that receives the afferents from the viscus. The pain of angina pectoris is referred to an area on the front of the chest and down the inner side of the left arm, and pain with the same distribution is felt when hypertonic saline is injected into the eighth cervical interspinous ligament (Kellgren, 1939; Lewis and Kellgren, 1939). A lesion of the central area of the diaphragm, which is supplied by the phrenic nerve, causes pain in the lower part of the neck and tip of the shoulder, the area of distribution of the third and fourth spinal segments. But is there a two-way traffic? Can stimulation of the tip of the shoulder alter the circulatory or motor functions of the diaphragm, or can heat over the front of the sternum or inner side of the left arm relieve cardiac pain? Sufficiently strong stimulation of any sensory nerve causes certain general effects upon the nervous, circulatory, respiratory and endocrine systems, but that is a different matter to a specific effect upon a given viscus.

It has been shown that anæsthetization with a 2 per cent. solution of novocain of a sufficiently large area of skin to which pain is referred will lessen or abolish pain of cardiac, pleural, gastric, renal, or appendical origin (Weiss and Davis, 1928), and that anæsthetizing the skin supplied by the third, fourth and fifth cervical nerves modifies pain induced by stimulating the under surface of the diaphragm (Morley, 1931). It might therefore be expected that counter-irritation of related skin areas would increase pain by augmenting the excitability of a spinal segment which previously was only receiving subliminal stimuli from the skin. But there is evidence (Head, 1920) that moderate heat of 40° to 45° C., although sufficient to stimulate pain fibres, causes a pleasant sensation of warmth and inhibits the sensation of pain. At a higher temperature, e.g. 50° C., the stimulation of pain spots is too intense to be inhibited and pain is then felt. Counter-irritation by heat may therefore act like a local anæsthetic in reducing referred pain. The whole subject has been little explored and at the moment it is idle to speculate.

Until the vexed question of referred pain is settled it is safer to regard the main action of counter-irritation as local and due principally to an increased blood flow, not only through the skin, but through deeper parts

in contiguity. It is a familiar experience that heat has a soothing effect upon an aching muscle, a strained ligament, or fibrositic pain. An increased blood flow would facilitate the removal of metabolites and toxins, relieve local inflammatory stasis, bring leucocytes and antibodies to the part, and increase the lymph flow. Pain would be relieved by the inhibition of pain fibres or by the removal of metabolites (Lewis's hypothetical P-substance) which act as direct irritants.

Whether it is desirable to increase the blood flow through an inflamed organ by heat or other method is debatable. In the past, inflammation was regarded as in itself a harmful process to be combated; but inflammation is the natural reaction to injury and, as Adami (1907) long ago pointed out, the right method is not to lessen or arrest but to stimulate and augment the reaction. Paradoxical as it may seem, the majority of cases of pronounced inflammation are examples, not of excessive but of inadequate reaction. The extent of the disturbance and the tendency to spread are indications that the body is for the time unable to control the irritant. The indications are to remove, if possible, the irritant and to promote, not reduce, the inflammatory reaction.

PRESENT-DAY METHODS

In medicine, as apart from surgery, counter-irritation is mainly used to-day in the large group of so-called rheumatic disorders and in certain diseases of the lungs and heart.

Local application of heat.—Fibrositis and non-specific arthritis are particularly suitable subjects because of the comparatively superficial position of the lesions and the poor peripheral circulation. In acute lumbago, injection of the localized painful areas with 2 per cent. procaine has an immediate effect, in which the *acupuncture* no doubt plays a part, and this can be followed up with heat. In chronic fibrositis the local anæsthetic will have only a temporary effect but will provide an opportunity for firm massage. Heat is the best form of counter-irritation and the choice of method is one of convenience. As most patients are treated at home a simple method which can be used by the patient or unskilled relatives is preferable. The application of a hot flat-iron over brown paper has long been a homely remedy and hot sandbags can be used when electricity is not available. Infra-red irradiation has in my experience been the most useful for home use. It should be applied every day for half an hour at bedtime. Not much result can be obtained from a visit to a clinic once or twice a week. An electric fire with a suitable reflector or a radiant heat lamp can be substituted but are less effective. For institutional treatment, when skilled staff and apparatus are available, *short wave therapy* with its power of directly heating the deeper tissues is of great value in relieving pain but has the disadvantage of unduly heating the highly resistant subcutaneous fat. *Inductothermy*, now mainly used for producing therapeutic

fever, can be used for local treatment if the area is not too small. It has certain advantages over short wave therapy and is a simpler technique.

Joints are peculiarly adapted to respond to an increased blood flow. Over the knee joint, for instance, several arteries anastomose to form a superficial wide-meshed network of fine vessels between the skin and fascia, and a deeper seated network of larger vessels in contact with the bones sending numerous offshoots into the joint. Similar anastomotic networks surround the shoulder, elbow, and wrist. During the acute stage of an arthritis relief of pain is sought by careful splinting in correct position, and moderate warmth will be comforting. At a later stage, when the need is for the absorption of exudates and inflammatory thickenings, an increased blood flow can be obtained by *infra-red rays*, *radiant heat*, or *baths of paraffin wax*. Short wave therapy has been advocated specially for gonococcal arthritis but has a wider range. *Blistering* and *cauterization* are still advocated but have no advantages. Before the introduction of salicylates the swollen and painful joints of acute rheumatism were often treated by applying a strip of blister an inch wide round the limb, just above and below the joint.

Except for histamine, the introduction of drugs by ionization is now little used, but the continuous current can be used for the relief of pain.

Counter-irritation in the form of *linseed* or *kaolin poultices* is commonly used for the relief of the pain of pleurisy. Presumably it acts by increasing the blood flow through the parietal pleura. In unskilled hands kaolin is more likely to cause burns than linseed, as it clings more closely to the skin. Certain relief of pain can be obtained by inserting 300 c.cm. of air between the layers of the pleura.

With the acute pleurisy of pneumonia other matters come into consideration. A large hot poultice will materially raise the body temperature. As the poultice is usually covered with cotton-wool or a Gamgee jacket, and the patient is warmly clothed and covered with many bedclothes, the loss of heat from the exposed skin is minimal. The idea still lingers that pneumonia is caused by cold and must be exorcised by heat. It is ironical that whilst the temperature is being raised by heat attempts may be made to reduce it by cold sponging. There is no doubt that the patient is more comfortable if lightly clad in a well-ventilated room and is allowed to have his arms outside the bedclothes. Pain can be controlled by morphine.

For bronchitis, rubbing the front of the chest with *turpentine* or *camphor liniments* is frequently done, but it is difficult to see how this can influence the circulation in the bronchial mucous membrane.

Leeches.—Acute rheumatic pericarditis is less often seen to-day, and candidates at final examinations have few opportunities of pleasing their examiners by pointing out the small triangular scars left by leech bites which indicate a former acute pericarditis. When pain is felt over the

front of the chest in pericarditis the mediastinal tissues are involved and many experienced physicians then regard leeches as the most effective remedy. Leeches, after being little used for some years, are coming into favour again, especially with ophthalmic surgeons for the treatment of glaucoma and iritis.

Cupping, dry or wet, is much favoured on the Continent but has fallen into disuse in this country. Years ago it was used with apparent benefit for such conditions as acute œdema of the lungs, acute nephritis and myalgia.

Ultra-violet light has had a long period of popularity and at one time no up-to-date surgery was complete without a lamp. It was much boosted as a general tonic and preventative of "colds" and for this purpose has been used in factories and offices. A large and controlled inquiry has shown no confirmation of the claim that artificial sunlight is effective in reducing sickness incidence or in promoting efficiency (Colebrook, 1946). This is, of course, no argument against its use in rickets or against open-air sunbathing when the effect of changing currents of air upon the naked skin come into account. Ultra-violet rays can be used as a counter-irritant for producing a local erythema and have some reputation for the treatment of chilblains and certain superficial skin conditions.

CONCLUSION

Counter-irritation has a wide range of usefulness as an accessory mode of treatment but, before it can be placed on a rational foundation and precise indications laid down, many carefully planned and controlled clinical investigations are needed and several gaps in basic physiological knowledge must be filled. Electrotherapy is giving us more measurable ways for providing heat, the best of counter-irritants, and increasing the blood flow when this is required. When available, it is replacing the crude empirical forms which have come down through the ages but which will still survive as useful home remedies.

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THE RÔLE OF PHYSICAL THERAPY IN RHEUMATIC DISEASE

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THE rôle of physical therapy in medicine is to build a healthy body: one which will overcome disease when present. There are three parts to this rôle when the disease is rheumatic in nature. First, to develop a sound body: one in which all the organs inside the trunk can and do function to their full capacity. Second, to restore the muscles to full tone. Third, to mobilize the joints to the greatest possible range of motion. The first will often stop the disease and will make the second and third possible, and by improved vitality help the healing of the damaged tissues of the muscles and joints.

The physical therapist must understand the nature of different kinds of rheumatism and arthritis in order to treat these conditions intelligently.

ETIOLOGY

The causes of rheumatic disease may be summed up, I believe, as a group of etiological factors which, when operating together, produce the constitutional derangements which we recognize as rheumatic disease. The joints seem to be an expression of a poorly working machine; they are symptoms, and the result of the failure of the normal health processes.

There are the factors of fatigue, emotional upset, deranged metabolism, such as is seen in low sugar tolerance, low basal metabolism, anæmia, rapid sedimentation rate, vitamin deficiency, especially of C, A, and B complex, acid sweat, and in focal infection, which always shows the lack of resistance of the patient himself. In all these factors physical therapy can play a part in restoring the patient to health through the correction of posture, by lessons in relaxation, by restoring the circulation of the extremities, by influencing the attitude of the patient towards his disease, his environment, especially his home life, and by disciplined training in the proper care of the body. This is particularly important, since rheumatic disease has a tendency to relapse with the recurrence of the environmental factors, both physical and emotional; for example, chill, colds, overwork, quarrels at home, discouragement, resentments, and fears. In my experience these all seem to cause a return of the joint manifestations of rheumatoid arthritis. All patients must learn to live in their environment. It is here that physical therapy can play a most important rôle. Let us therefore describe the rheumatic diseases of greatest importance in which physical therapy is necessary.

TYPES OF RHEUMATIC DISEASE

Rheumatic disease of all types is a constitutional illness which affects all

the fibrous tissues of the body—the mesenchyme. In *fibrositis*, the fibrous tissue of the muscles is chiefly involved, giving rise to pain, stiffness and tenderness of the muscles; sometimes the bursæ only are inflamed; again the articular structures about the joints are the seat of the trouble. The use of the muscles in ordinary motion in all these conditions is naturally painful.

Rheumatoid arthritis is also a constitutional disease: it is far more widespread in the body than fibrositis and more crippling, because of the actual destruction of the joint tissues and the formation of adhesions with fibrous and ultimately bony ankylosis. This is the worst type to control.

Osteoarthritis does not have fibrous adhesions to limit motion but is primarily a joint change, the result of physical or chemical trauma over many years. It causes bone growth at the edges of the joint, thus limiting motion by blocking. The pain is due to the impingement of these ridges and results in muscle spasm, as it does in all these types of joint disease.

Ankylosing spondylitis is an inflammatory disease of the vertebra beginning usually in the sacro-iliac joints and small articular facets, and causing fusion of the whole spine. This fusion results in a stiff back from ossification of the intervertebral ligaments, but before this there is pronounced muscle spasm and pain.

As I have said, one of the essential factors, possibly the most essential, in the recovery from rheumatic disease of all types is a well functioning body. Correct alignment and correct use of the body give normal working of all the parts. Every bit of good health is necessary to fight the constitutional disease through the normal resources of resistance. Resistance to disease depends upon the normal action of the viscera inside the body, and this cannot take place with full power until the trunk is used correctly without displacement or pressure on the vital organs, such as the heart, lungs, liver, stomach and pancreas. The coordinated free functioning of the organs of digestion, metabolism and elimination is imperative. It has been shown by Goldthwait (1946) that poor body mechanics handicap all vital processes everywhere in the body. Proper posture, on the other hand, aids good circulation and normal activity of the viscera.

POSTURE

Correct posture is obtained and maintained by means of a rest position called "hyperextension". *Hyperextension* is taken lying down in bed with no pillow under the head, with the arms raised and the hands under the head. A pillow is put under the knees for relaxation. Sometimes a pillow is placed under the shoulders if the patient can stand the stretching (he usually can in a few days). This position is taken three times a day after meals for one half-hour. It is best to try to have the elbows touching the bed as this gives expansion to the chest by raising the ribs and tightening the suspensory ligament of the diaphragm. The full excursion of the diaphragm gives the best aeration of the lungs and returns the venous blood to the heart from the

abdomen by its pump action on the vena cava. The usual bed position with several pillows is most detrimental to the circulation, as it hampers the diaphragm and crowds the mid-body organs at the point of buckling. The position of hyperextension should be taken after meals, whether in bed or up and about. If in bed continuously, only one pillow should be used between positions. Rest in bed half sitting up undoes all the good body mechanics we are trying to accomplish, as it is the position most apt to produce crowding.

The second means of restoring good posture is by *corrective exercises*. This is where the physical therapist can do most. After consultation with the doctor she must be responsible for the daily supervision of the way these exercises and positions are carried out. The object is to straighten the back, especially the dorsal spine and the lumbar curve. This cannot be done until the costal angle in front is wide and the ribs free. Therefore the physical therapist should begin with breathing exercises to free the ribs and expand the chest. The position of hyperextension as described above taken on the floor, or on a stiff bed, is the position to start with. The hands are placed under the head, the elbows touch the floor, if possible, the chin is pulled in and the knees are bent to flatten the back. Holding this position the patient breathes in deeply ten times, and with each expiration he contracts the abdominal muscles strongly to expel the air completely. To mobilize the ribs he "shrugs" first the right, then the left shoulder and stretches the whole side with a deep breath alternately, while assuming the same position as in exercise number one; this is repeated ten times.

The third point is to *flatten the lumbar spine* and develop the muscles to do this. The same position on the floor is used. Then the buttock muscles are contracted and held while the tip of the spine is rolled up, rotating the pelvis. The lumbar spine should touch the floor. Then the abdominal muscles are contracted firmly and slowly. This whole exercise is repeated ten times, but can be done many more times with practice.

All exercises should be done slowly and thoughtfully, relaxing between each exercise to ensure an inflow of blood. This develops the muscles so that they can hold the corrected posture while sitting and standing later. This is the real object of the exercises. The physical therapist must supervise these exercises daily at first until confident that they are understood, the objective mastered, and they are perfectly done. Poorly executed exercises are worse than none at all. If persisted in, correct posture and better health and resistance are sure to result. As I have said, this is the most important single rôle of physical therapy in arthritis. Most patients can do body work long before they can use their extremities and their joints. These body exercises in no way cause difficulty for the joints. I have given the ideal position for taking them, but any approximation to these can at first be used when necessary.

When supine exercises have been mastered the same exercises can be begun sitting and later standing against the wall instead of using the floor as a

support. It is not enough to do the exercises and then slump to the old posture again. Attention should be given by the patient to the training and he should learn to use his body correctly at all times. This is where teaching is important. The physical therapist must be backed constantly by the doctor until the patient realizes the importance of what he is learning to do and the reason for it.

REST

Rest is necessary for the replenishment of the body tissues which are fighting a losing battle unless they are allowed to rebuild their vitality through better circulation and drainage: especially is this true of the muscles, and with this the physical therapist is chiefly concerned. The abdominal circulation is better for periods of rest, and there is more economy of work for the organs in their important function of supplying the proper blood chemistry to all parts of the body. One way the physical therapist can help in this is to teach the patient to relax and stop tension in rest, for where there is pain there is muscle spasm, and spasm causes atrophy if it is continued long enough. The complete relaxation of a muscle will allow it to get its proper blood supply and will also ease up on the pressure and pull on the periarticular tissues about the joints so that the lymphatics can drain the fluids and the swelling can be reduced. Constant spasm keeps joints sore. It is the physical therapist's task to teach rest in complete relaxation. This is hard to learn, and lessons have to be given many times to accomplish this necessary part of the treatment. The rest from splints during the acute stages of rheumatoid arthritis is so effective in reducing the pain, swelling and inflammation, because of the complete rest, and this is also why atrophy of the muscles is less. I find that pannus and thickening is less when the joints are put at complete rest.

Lessons in *muscle contraction* without joint motion or pain are also important. The individual care of each muscle about a sore joint can be given by contracting and relaxing it and by guarded use in flexing and extending the joint. Here the physical therapist can be of essential benefit to the patient and doctor.

HEAT

Heat plays an immensely important part in relaxing the muscles and bringing pillow is 'pūl supply to the damaged joints by hyperæmia. The type of heat under the shoulder's difference in my experience: diathermy, dry baking, or in a few days). This-tations. I use the fomentations because they can be given half-hour. It is be-ic, at home as well as in a hospital, in bed or out, and more expansion to the er forms of heat. They save money, trauma, and travel to a ligament of the d require no more nursing. I believe that wet heat is more best aeration of the Y, baking.

important means of heating the muscles as a whole. The

sweating produced by baths increases the elimination of the waste products of muscle activity. The sweat is often more acid in the rheumatoid arthritic than in the normal person and he will require many sweats to become neutral in twenty minutes of the bath.

MASSAGE

Massage is also an excellent physical therapeutic measure, if confined to the muscles and not the joints. Joints must not be stirred up or traumatized. Massage is a mild form of exercise and relaxes the muscles if not given too strenuously. It improves the circulation in the muscles and will not cause fatigue if given gently. Soreness should never follow massage. Heat followed by massage gives the best results. Massage of the rheumatic case is a special art in itself, and is difficult to learn, but it has a very important part to play in the recovery of normal motion and use of the joints. During massage the lessons in relaxation can very well be taught.

USE OF THE MUSCLES

As the inflammation in the joints goes down with rest, more graded use is possible, but this must be carefully supervised and planned for each joint. The joint must not be hurt in any way to start up the inflammation again. In no circumstances are violent exercises needed, and no undue trauma should be produced by over-zealous stretching. *Stretching of muscles* should only be instituted under the personal and frequent supervision of an orthopædic surgeon. Gentleness in handling joints is an important factor in the rapid recovery. Never persist when pain is produced.

After passive exercises comes active work with the normal motions of the joints. Elastic or balanced supports for the extremities are needed at first. The time for exercise must be regulated by the reaction in the joint after the exercise has stopped.

Occupational therapy is instituted at this point in the treatment, for use is better if there is fun and if it is for a purpose. Recovery is faster, for joints were meant to move and are healthier when used, but not when they are inflamed or sore. Even if I repeat myself let me emphasize:—first, rest and protection and relaxation until the inflammation is gone; then, and then only, comes passive motion and educated control. Finally, active use in the normal pursuit of life in the limits of pain.

CONCLUSION

The rôle of physical therapy is an essential one in the treatment of all joint conditions, and the care with which this form of treatment is planned may determine the time element in the progress of these difficult cases. The protection, expert instruction and the grading of treatment by the physical therapist under the doctor's direction, can and does shorten the period of

support. It is not enough to do the exercises and then slump to the old posture again. Attention should be given by the patient to the training and he should learn to use his body correctly at all times. This is where teaching is important. The physical therapist must be backed constantly by the doctor until the patient realizes the importance of what he is learning to do and the reason for it.

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Baths are also an important means of heating the muscles as a whole. The

ELECTROTHERAPY IN GENERAL PRACTICE

By L. D. BAILEY, C.B., M.C., M.R.C.S., L.R.C.P., D.P.H.

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ELECTROTHERAPY in private practice, or indeed in any practice, should be undertaken only by those who have a clear understanding of the physical properties of the agents they are employing and of the physiological effects of these agents on the living tissues of the human body. To employ electrotherapy merely as a means of increasing practice or income without any idea of its beneficial or harmful effects is not only unscientific, but may have disastrous effects on the patient and bring this undoubtedly valuable form of treatment into disrepute. On the other hand, electrotherapy, at present in its infancy, should, with ample opportunity for research, develop into one of the most powerful adjuncts to medicine.

When we consider the advances which have been made during the late war in radiolocation and transmission, and at the same time realize that the human body is constantly surrounded by electro-magnetic waves, which are both unappreciable and harmless but which nevertheless are a considerable factor in the maintenance of health, we come to the conclusion that it is only by concentration of specific wave lengths on any of the human tissues that we can influence them for good or for evil. It is therefore by bombardment of the tissues with electrical currents or the products of these currents that results are obtained. This being the case, it is obvious that the practitioner must have an intimate knowledge of the construction and output of the appliances which he is going to use, as well as a clear conception of the effects which he wishes to achieve.

The chief bars to electrotherapy in private practice are the length of time which is necessary in some cases for the achievement of these effects, the necessary expenditure on apparatus, and floor space required for its installation. The dosage, as in other branches of medicine, must be accurate and occasionally progressive. Incompatibility of certain forms of electrical treatment with certain drugs which the patient may be taking, and contraindications to treatment altogether, must be borne in mind, whilst hypersensitivity to electrical treatments, whether allergic or induced by drugs, must always be considered. All these facts, as well as a description of the apparatus, can be gleaned from books on the subject, and it is obviously outside the scope of this article to enter into details of this nature.

My object is to discuss the nature of the physical agents employed in electrotherapy, omitting any reference to X-rays and radium, as well as to artificial fever therapy, which requires a team of workers specially trained for its administration, and to emphasize some of the conditions which

illness. It may be the important factor in recovery.

Physical therapy has three essential things to deal with. First, the patient's control of his own muscles; second, his discipline in required work; and third, his cooperation with someone else. He also learns to control his body for his own good and to relax at will. The massage and the exercises are an easy way to teach him things about his body which he has possibly never learned before. The lack of this care and indisciplined living may have been factors in the causation of his illness, and in any case it can be a deciding factor in his recovery. The lessons learned under the watchful eye of a conscientious and intelligent physical therapist may prevent the next attack.

Another point: except for the nurse, the physical therapist spends more time with the patient than anyone else, and often learns more of the home problems, the disappointments, the fears and the frustrations of her patient. She has the golden opportunity to get over to her patient important lessons in living, cooperation and philosophy of life, if she is the right type. She can do much to help the doctor by her intelligent understanding of the significance of the things she hears. The caring doctor can learn much from such a physical therapist and can do much to encourage the patient to work for the things he needs to have: a robust body, a peaceful mind and a faith. The patient must be looked upon as a whole individual and treated as such.

There are no set rules in the treatment of rheumatic disease. Every case is an individual problem. Ingenuity is needed for the successful planning for each case. The principles are the same although the methods of application vary. In general, the rôle of physical therapy is to develop as perfect a body as possible, which will function correctly. Towards this end all the treatment is directed. It demands the cooperation of the doctor, the patient, and the physical therapist, and a vision of what the patient can be with conscientious care.

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heavy, but should not exceed 2 milliamperes of current per square inch of pad. Great care must be exercised on the appearance of granulation tissue, either by modifying the dose or insulating the granulations in order to prevent their destruction. An electrode of the same metal should be employed. It must be realized that there is quite an appreciable absorption of metallic ions from a raw surface.

I had an interesting example of this when treating a large and foul bedsore in a paraplegic patient. Collosol argentum was used and the treatment was given daily, the current being stepped up rapidly on account of the septic condition of the wound. After a week or so the bedsore had greatly improved, but the patient complained of nausea and frequency of micturition. A specimen of the urine was tested and was found to contain an appreciable amount of pure silver. As it was considered that this was a waste of precious metal and that the condition of subacute nephritis might become chronic, the treatment was discontinued and another less expensive form adopted.

Magnesium ionization is a useful form of treatment for multiple small warts. Sixteen layers of lint are soaked in a 2 per cent. solution of magnesium sulphate and applied under the anode to the affected part, the cathode being placed either directly opposite or at some convenient part of the body. The current density conforms to the size of the pad used, and the duration of the treatment may last from fifteen to thirty minutes every other day.

Lithium ionization, in the form of lithium iodide, can be used effectively in cases of gouty arthritis. It is essential that the diagnosis should be correctly established by clinical observation, history, X-ray examination, blood uric acid and sugar tolerance tests, as other forms of arthritis do not respond to this treatment. Given a true case of gout, however, much can be done to alleviate the pain and cure the condition by passing a constant current through a 2 per cent. solution of lithium iodide with pads placed on either side of the affected joints. The current density and duration of treatment will depend upon the size of the pads and the condition of the joint, whether acute or chronic.

Histamine ionization.—In an article entitled "Electrical Treatment in Rheumatic Conditions" (Bailey, 1938), a full description of histamine ionization is given, from which I shall quote, with a few alterations in the light of present knowledge.

"The introduction of histamine through the skin by ionization has been of infinite value, and in obstinate cases of fibrositis leading to brachial or sciatic neuritis occasionally acts like a charm when other methods have failed. Omitting its action on unstriated muscle and on secretory glands its circulatory action is very marked. Histamine made to permeate the skin by means of ionization causes a triple response:—(1) Local dilatation of capillaries by direct action. (2) Widespread dilatation of surrounding arterioles from a local axon reflex. (3) Local increased permeability of the walls of minute vessels causing wheal formation.

The appearance of the skin after treatment is important. It may be:—(a) Warm and pale, indicating dilated arterioles and constricted capillaries; (b) warm and red, indicating dilated arterioles and dilated capillaries; (c) cold and red or blue, indicating constricted arterioles and dilated capillaries.

Therefore the object of treatment should be to produce the effect of (b), as presumably the deeper vessels will also be dilated. This is by no means easy of accomplishment, as different individuals react differently to the drug, and the same

respond most readily to electrical treatments, in the hope that even if the general practitioner does not himself administer electrical treatments it may convey to him the type of case which may benefit therefrom, and the reasons why results may be expected.

What then are the physical agents with which we have to deal in electrotherapy? They may be summed up into four categories:—(1) Electrical currents—direct, alternating and oscillating; (2) heat; (3) light; (4) certain wave lengths in the electro-magnetic field outside the visible spectrum.

THE GALVANIC CURRENT

The constant current, commonly known as the galvanic current, has several uses. In the first place it must be understood that this current traverses the tissues by regular "ionic" movement of salts in solution in the body, and that during its passage it meets with a certain amount of resistance, the most resistant tissue in this case being the skin.

Alkalis accumulate under the cathode and acids under the anode, either of which in concentration may cause an electrolytic burn. For this reason the amount of current dosage must be accurately prescribed according to the size of the conducting pad used and the duration of time of administration specified, as must also the strength of solution of any salt used to moisten the pads. These simple points are emphasized because the type of prescription so often seen is so sketchy that it is hardly worthy of the name; but nevertheless, the practitioner has to be responsible for any untoward symptoms or accidents arising from the treatment. The condition of the skin must also be taken into consideration, whether any abrasions or paræsthesiæ exist or whether the blood and lymph supply is adequate, in the event of which, insulation of the abraded part and considerable modifications of the maximum dose (namely 2 milliamperes of current per square inch) may have to be insisted upon. The ions most commonly used are:—

Under the anode

Zinc
Copper
Argentum
Magnesium
Lithium
Histamine
and of late
Sulphonamides
Penicillin

Under the cathode

Chlorine
Iodine
Salicylic

All these ions are driven into the tissues either directly or in combination in 1 or 2 per cent. solution. As only a certain number of ions can be introduced in any specified time, according to the weight of the ion, any stronger solution is of no avail.

Zinc, copper, and silver ionization are chiefly used for their antiseptic and stimulating properties in open wounds, ulcers, sinuses and chronic otitis media. The dosage depends upon the degree of infection and the impoverished blood supply to the part. The initial dose may of necessity be

heavy, but should not exceed 2 milliamperes of current per square inch of pad. Great care must be exercised on the appearance of granulation tissue, either by modifying the dose or insulating the granulations in order to prevent their destruction. An electrode of the same metal should be employed. It must be realized that there is quite an appreciable absorption of metallic ions from a raw surface.

I had an interesting example of this when treating a large and foul bed sore in a paraplegic patient. Collosol argentum was used and the treatment was given daily, the current being stepped up rapidly on account of the septic condition of the wound. After a week or so the bed sore had greatly improved, but the patient complained of nausea and frequency of micturition. A specimen of the urine was tested and was found to contain an appreciable amount of pure silver. As it was considered that this was a waste of precious metal and that the condition of subacute nephritis might become chronic, the treatment was discontinued and another less expensive form adopted.

Magnesium ionization is a useful form of treatment for multiple small warts. Sixteen layers of lint are soaked in a 2 per cent. solution of magnesium sulphate and applied under the anode to the affected part, the cathode being placed either directly opposite or at some convenient part of the body. The current density conforms to the size of the pad used, and the duration of the treatment may last from fifteen to thirty minutes every other day.

Lithium ionization, in the form of lithium iodide, can be used effectively in cases of gouty arthritis. It is essential that the diagnosis should be correctly established by clinical observation, history, X-ray examination, blood uric acid and sugar tolerance tests, as other forms of arthritis do not respond to this treatment. Given a true case of gout, however, much can be done to alleviate the pain and cure the condition by passing a constant current through a 2 per cent. solution of lithium iodide with pads placed on either side of the affected joints. The current density and duration of treatment will depend upon the size of the pads and the condition of the joint, whether acute or chronic.

Histamine ionization.—In an article entitled "Electrical Treatment in Rheumatic Conditions" (Bailey, 1938), a full description of histamine ionization is given, from which I shall quote, with a few alterations in the light of present knowledge.

"The introduction of histamine through the skin by ionization has been of infinite value, and in obstinate cases of fibrositis leading to brachial or sciatic neuritis occasionally acts like a charm when other methods have failed. Omitting its action on unstriated muscle and on secretory glands its circulatory action is very marked. Histamine made to permeate the skin by means of ionization causes a triple response:—(1) Local dilatation of capillaries by direct action. (2) Widespread dilatation of surrounding arterioles from a local axon reflex. (3) Local increased permeability of the walls of minute vessels causing wheal formation.

The appearance of the skin after treatment is important. It may be:—(a) Warm and pale, indicating dilated arterioles and constricted capillaries; (b) warm and red, indicating dilated arterioles and dilated capillaries; (c) cold and red or blue, indicating constricted arterioles and dilated capillaries.

Therefore the object of treatment should be to produce the effect of (b), as presumably the deeper vessels will also be dilated. This is by no means easy of accomplishment, as different individuals react differently to the drug, and the same

individual may react differently on different days. The required result may be achieved, however, by moderate currents (3 to 10 m.a.) for five to ten minutes".

From experience in a great number of cases I rarely exceed 5 m.a. at the present time as, in my opinion, if no reaction occurs in the skin with this amount of current, no increase will achieve the object, but will merely produce constitutional disturbances of a dangerous nature.

"Following the initial dilatation there may be fall of blood pressure, which, if the treatment is continued unduly, may lead to circulatory failure, inadequate blood flow to the brain, syncope and cessation of respiration. If, however, the treatment is administered intelligently these extremes can be avoided. The earliest sign of constitutional effects is flushing of the face or neck owing to dilatation of arterioles in this vicinity. Should this occur treatment should be stopped immediately, as though circulatory failure may not occur the patient may subsequently suffer from severe headache and vomiting."

Histamine is most conveniently administered by the application of histamine jelly or ointment (sometimes known under the proprietary name of "inadyl"). This can be lightly rubbed into the skin, preferably with cotton-wool or a rubber glove to protect the operator, and over this are placed the usual sixteen layers of lint soaked in normal saline, and the positive electrode. The cathode soaked in 2 per cent. sodium salicylate may then be placed over the chief site of referred pain and a current of 3, 4 or 5 m.a. for five to ten minutes passed daily for a week, or three times weekly for two weeks, and the result noted. If there is no improvement in the fibrositic condition noticed after six treatments, it is useless to continue with this type of medication. Besides fibrositis and neuritis other conditions which will greatly benefit from histamine ionization are vascular deficiencies, such as Raynaud's disease, acrocyanosis, and early cases of arteriosclerosis.

Sulphonamide ionization with the sodium compound of these drugs in a 2 per cent. solution has proved most valuable in the treatment of chronic infective ulcers and wounds, in cases which have resisted all other forms of treatment. The application should be made under the cathode, with a layer of gauze soaked in the solution, a strip of cellophane applied over this and then the usual sixteen layers of lint soaked in a 2 per cent. solution of sodium chloride placed over the cellophane. According to the size of the wound and the size of the pad a current of 2 to 5 m.a. for ten to twenty minutes may be passed daily until repair is beginning to take place, when treatments may be given three times weekly.

Penicillin ionization may merely be mentioned to be discarded, as this has been tried but found not to be ionizable in its true composition.

Chlorine ionization takes place whenever sodium chloride is used to transmit the constant current through a pad without any appreciable effect when the ions are driven in under the cathode. It is, however, said to soften scar tissue, and is frequently used for this purpose.

Iodine ionization can be carried out either by using a 2 per cent. aqueous solution of iodine or by placing the cathode over a 2 per cent. solution of potassium iodide. Its uses are for septic wounds, or for rheumatic or gouty conditions. Some skins do not tolerate iodine well, and for that reason small

currents for a short time are generally given in the initial treatments.

Salicylic ionization is used chiefly for rheumatic conditions, although it is questionable how much of the drug ever enters a joint at all deeply situated.

Some years ago an interesting experiment was carried out by Murray Levick. A patient whose foot had to be amputated was given an ionization through and through for half an hour immediately before operation. After amputation all the tissues of the foot were subjected to tests for the presence of salicylic ions but no trace was found, the inference being that they are very rapidly carried away by the lymph and blood streams.

Salicylic ions, however, have undoubtedly an analgesic effect on superficial nerve endings and are frequently used for this purpose. Mention may be made here of a combination of the above ions in a preparation known under the trade name of T.C.P. (tri-chlor-phenyl-iodo-methyl-salicylate). Applied under the cathode this drug, used at half strength, will create an intense vasodilatation of a superficial nature and by reflex action a deeper vasodilatation in the vicinity; thus it is a valuable drug in the treatment of chronic rheumatoid arthritis, when the joint itself is not markedly involved.

The constant current applied through a normal saline solution has a marked effect on certain types of œdema (notably traumatic œdema). The anode should be placed on the œdematous part and the cathode either on the upper extremity of the lymph channels draining the part, or at some distant part of the body, such as the opposite hand or leg. The limb should be placed in elevation and a small current, 1 to 7 m.a., passed for twenty to thirty minutes once or twice a day. I have employed this method, in consultation with the surgeon in charge, in cases of severe burns of the extremities which were dressed with a normal saline solution. Electrodes were incorporated in the dressings which were moistened with sterile salt solution each time a treatment was given, and a current of $\frac{1}{2}$ to 1 m.a. was passed for one hour twice daily until the œdema had subsided, which in the majority of cases occurred much more rapidly than in control cases in which no current was used. The assumption is that by alteration of the electronic balance of the tissues, osmosis of fluids occurs from the tissues to the smaller vessels. Samson Wright says, "The envelopes of the red blood cells are freely permeable to water, are partially permeable to anions, e.g. Cl, but are almost impermeable to kations, e.g. Na".

THE INTERRUPTED GALVANIC CURRENT

If of sufficient strength the interrupted constant current will cause a contraction of muscle fibres at the make, and to a less extent at the break, of the current in a healthy muscle. This will be referred to again under the heading of electro-diagnosis. At the same time the sensory nerve endings in the skin are stimulated, leading again to an arteriolar dilatation, and in consequence the circulation in the skin can be improved considerably. This mode of treatment, among others, is valuable in cases of chilblains and acrocyanosis, and complaints of a like nature. It is usually administered by immersing the limb in a warm water bath, using sufficient current to cause

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tion of flow from anything between 5,000 to 1,000,000 in long wave diathermy and to 50,000,000 times per second in short wave therapy, owe their therapeutic effects to the generation of heat in the tissues. The practitioner who is going to use these currents in private practice must be aware of a few fundamental principles.

(1) These currents are of high voltage, 2,000 to 4,000 volts of current being employed, and the consequent amperage employed is relatively high.

(2) The heat produced in the tissues is due to the resistance of the tissues to the passage of the current. Whereas in the constant current the most resistive tissue is the skin, in high frequency currents the most resistive tissue is fat. After fat—bone, skin, muscles, and nerve and connective tissue are respectively resistant in this order, but it must be realized that both blood and lymph are good conductors of the current.

(3) Unlike the constant current, oscillating currents are not conveyed through the tissues by ionic movement, but by conduction from one ion to another, and by induced currents from cell to cell (electro-magnetic induction).

Although the patient appreciates the warmth of the current in the skin it is a poor criterion of the amount of heat produced in the deeper tissues, such as fat and bone, and for this reason deep-seated burns may occur which are not immediately evident. This is, doubtless, the chief danger of diathermy and short wave applications. Other untoward effects may be dizziness if the treatment is administered near the brain, and syncope if a large area of the body is being treated. Although these treatments may be given with good effect to the whole body for the amelioration of symptoms, such as headache, flushing and vertigo in cases of high blood pressure, they should be administered very cautiously in patients suffering from abnormally low blood pressures. The application of warmth in cases of rheumatism is too well known to need any emphasis here, but the deep-heating effects of these currents render them especially efficacious in chronic rheumatoid arthritis and early osteoarthritis.

"The physiological effects of heat applied to the body are hyperæmia and sensory and motor sedation" (Norris, 1946).

Hyperæmia denotes dilatation of capillaries and arterioles, causing a better and easier flow of blood through the affected part which, if taking place over a large area, accounts for the lowering of the general blood pressure.

Sensory sedation implies a lessening of pain, which is the first and probably the chief action noticed by the patient.

Motor sedation is evidenced by the relaxation of muscle spasm, whether it be caused by trauma, joint infection or nervous disease. In all these instances the spasm can be temporarily relieved by the use of long and short wave diathermy.

Another effect of heat in the deeper tissues must not be lost sight of, namely, a direct bactericidal effect on certain organisms, notably the gonococcus, which have what is known as a low lethal temperature, and

a slight contraction of muscles at the make, and continuing the treatment for fifteen to thirty minutes daily. It is useful to have a metronome in the circuit which will regularly reverse the current at each make.

ALTERNATING CURRENTS

Alternating currents may be of high or low frequency, that is to say current as used for medical purposes may alter its direction of flow from 50 to 50,000,000 times per second. Dealing first with low frequency alternating currents chiefly employed are the sinusoidal current and the faradic current. The sinusoidal current in most modern apparatus conforms to the periodicity of the main current supply suitably reduced in voltage for the apparatus employed. It stimulates both muscle and skin nerve endings and can therefore be used to produce either muscle contractions or skin stimulation but, owing to its somewhat painful effect when used at sufficient strength to cause muscle contraction, it is not as a rule used for this purpose and is definitely inferior in action to the faradic current. Its chief use, like the interrupted galvanic current, is for circulatory disturbances, such as general impoverished circulation in the extremities, Raynaud's and Bazin disease.

THE FARADIC CURRENT

The faradic current has three principal uses:—(a) Muscle stimulation (b) sensory nerve stimulation; (c) electro-diagnosis.

The use of surging faradic stimulation for weak muscles is so well known that it needs no emphasis here. Suffice it to say that the best results are obtained by long and frequent treatments of twenty to thirty minutes twice daily, and by the re-education of voluntary contraction of the muscles during the treatment. A factor which is less well known is that painful conditions such as acute foot strain and acute lumbago can be relieved considerably by faradic contractions. Spasmodic flat foot and lumbago are caused by accumulation of lactic acid in the muscles, due either to prolonged standing and consequent inactivity of the intrinsic muscles of the foot or to a lymph stagnation in the muscles of the back. I have no hesitation in prescribing surging faradic footbaths or surging faradism for the foot or lumbar muscle provided the patient will tolerate the treatment. Massage is contraindicated as it is muscle movement that is required, and the patient can hardly be expected to do this for himself when every movement causes him acute pain. Many are the patients who have acknowledged immediate relief in painful foot conditions from this treatment, and on one occasion I cured an attack of lumbago in myself by faradic contractions of the lumbar muscles for fifteen minutes followed by diathermy through the same muscles for another fifteen minutes, administered twice in twenty-four hours. Other uses of the faradic current will be considered under electro-diagnosis.

THE OSCILLATING OR HIGH FREQUENCY CURRENT

Oscillating currents, or currents of high frequency which alter their direc-

Biochemical effects include erythema, pigmentation, the activation of cholesterol (with consequent liberation of vitamin D), quiniodine (which stimulates nerve endings) hormones, inorganic salts, increase of red cells and hæmoglobin, metabolism and endocrine glands.

Bacteriological effects. Destruction of bacteria. Stimulation of antibodies, increase or decrease of leucocytes according to the wave lengths used, and the length of exposure of the part.

Empirical effects, such as irritation, thermal, superficial, deep, and psychological".

We have therefore in our armamentarium for irradiation powerful weapons for the alleviation of many maladies, a few of which may be mentioned here:—

DISEASE	GENERAL IRRADIATION	LOCAL IRRADIATION
<i>Respiratory system</i>		
Asthma and bronchitis	To chest, back, front and sides, 1st erythema dose thrice weekly. Carbon A and C or mercury vapour lamp and I.R. rays to warm. Increase dose by 1 min. up to 7 min. and thereafter by ½ min. up to 15 min.	i.e. local to front, back and both sides of chest in rotation. I.R. rays preferably given to opposite side
Whooping-cough	Prolonged whoop. As above	As above
<i>Alimentary system</i>		
Infective colitis	1st erythema doses to front and back of trunk and to legs back and front in rotation, to raise resistance	
Mesenteric glands	Tuberculous and non-tuberculous. As above	
Constipation	As above to increase general tone of muscles	
<i>Circulatory system</i>		
Anæmia, primary and secondary	1st degree erythema to whole body, front and back of trunk, legs back and front in rotation	
Chilblains	If general condition indicates	2nd degree erythema to affected parts, increase by 1 min. thrice weekly for four weeks
Raynaud's disease	Ditto	As above
<i>Skeletal system</i>		
Arthritis and tuberculous infection of joints		Infra-red irradiation
Bursitis		3rd degree erythema over the site of the bursa. To be immediately strapped with "elastoplast" and left for one week
<i>Nervous system</i>		
Anterior poliomyelitis	1st degree erythema to whole body in rotation if indicated	
Insomnia	As above	
Neurasthenia	As above	

which can be destroyed *in situ* by temperatures of 101° to 104° F. (38.3° to 40° C.). Before the introduction of the sulphonamides and penicillin I have had successful results in gonococcal arthritis, not from treating the affected joints themselves only, but by treating simultaneously the prostate gland, which was the source of residual infection. In obstinate cases the same procedure is worthy of consideration, even in these days.

Cardiovascular disease.—In my experience, except for the fact that the pain of angina pectoris can be relieved definitely by the frequent application of long or short wave currents through the heart, thereby dilating the coronary arteries, the treatment of conditions such as arteriosclerosis in its advanced form, Raynaud's and Bazin's disease, has proved not only disappointing, but in some cases dangerous. For instance, these currents should never be applied directly to any part of the body where gangrene is threatened, as it will only hasten the process by congesting the part with blood which cannot be adequately drained away. In cases of inflammation, however, such as boils, carbuncles, septic antra and frontal sinuses, in which an improved blood supply is imperative, treatment by deep heating has remarkable effects.

IRRADIATION

Heat, light, infra-red and ultra-violet irradiations may be considered together in the first instance as they have all the physical properties in common. That is to say, these rays, whether derived from the sun or from artificial sources are either (a) absorbed, (b) transmitted, (c) reflected, or (d) refracted, according to their wave length. Other laws which these rays obey are:—

Grotthus's law.—Only the rays absorbed are effective in producing chemical changes.

Intensity of irradiation.—The intensity varies inversely with the square of the distance from the source.

Reflection of rays.—The angle of incidence equals the angle of reflection.

The practitioner has therefore to realize that certain rays only will penetrate the living skin, and these produce chemical changes, and that those rays which fall on the skin at right angles to the source of supply are the most penetrating, in that they are not reflected from the surface.

Refraction of rays.—All rays are refracted from their original path by passing through certain media, e.g., a prism of glass. A thorough knowledge of the spectrum of the rays emitted from any source must therefore be a *sine qua non* before treatments can be undertaken. The rays employed at present for therapeutic purposes comprise those of the visible spectrum and certain wave lengths outside.

The visible spectrum is well known and is composed of seven colours, red, orange, yellow, green, blue, indigo and violet. Beyond the red end begin the infra-red rays, and beyond the violet end the ultra-violet rays. The respective wave lengths of the therapeutic rays are as follows:—

Ultra-violet	..	..	..	..	..	1,900 to 4,100 Å
Visible spectrum	..	..	..	..	..	4,100 to 7,700 Å
Infra-red	..	..	..	..	..	7,700 to 150,000 Å

Å (an angstrom unit) being $1/10,000,000$ th part of a millimetre. The physiological effects of ultra-violet rays, so far as our knowledge extends at the present time, are according to Beaumont (1946):—“(1) Biochemical; (2) bacteriological; and (3) empirical.

sensory loss as hysterical. For instance, the patient is unable to appreciate the current perhaps in the hand and lower arm, but will volunteer the information that he or she can feel the current higher up the arm. One electrode, preferably a large one, is placed over the roots of the affected nerves as they emerge from the spinal canal, and the other electrode is stroked from the fingers up the arm until the current is felt. The exact place is then noted. Pressure with the finger is then made deeply at a point below this, and the patient is asked to concentrate on this spot. The electrode is again stroked from the fingers up the hand and forearm, and almost invariably when it reaches the spot where deep pressure has been applied the patient will confess to feeling the current. Pressure is again applied lower down the limb and the same procedure is repeated until in some cases the feeling all over the affected area can be restored at one "sitting". The condition is liable to relapse, but by daily repetition of the treatment will very soon be cured. Needless to say the diagnosis is obvious.

Myasthenia gravis.—In this distressing complaint it is a well-known fact that repeated voluntary contractions of certain weakened muscles result eventually in cessation of movement. The same phenomena can be produced by repeated stimulation by the faradic current of muscles showing definite weakness, although the number of contractions necessary to cause cessation of movement with the same amount of current may run into two or three hundred before a result is obtained. If after this number of contractions the muscle completely fails to react then the myasthenic reaction is said to be complete. If, on the other hand, the muscle fibres show a very definite lessening of contraction the reaction is said to be partial. This test may be a valuable asset in the confirmation of a clinical diagnosis. It must, however, be undertaken before the administration of prostigmine.

Myotonia congenita.—Here the muscles are in a state of hypertonus, and they are hyperexcitable to both the faradic and galvanic currents, as evidenced by a tetanic contraction being obtainable not only by the faradic current but also during the whole duration of the galvanic current, whereas in normal muscle the contraction of the muscle takes place merely at the make and, if strong enough, at the break of the current. This test is diagnostic of the disease.

THE ELECTRO-MYOGRAPH

A great deal of work in this country has been done by Bauwens (1946) and others. The gist of Bauwens' experiments are as follows:—

"That though the exact nature of the electro-motive forces at work in the excitable tissues still lends itself to discussion, it is an accepted fact that these tissues are the site of phenomena of electric polarization and that this polarization varies according to the state of these tissues."

"In the case of neuro-muscular fibres, the polarization exists during the state of rest and is momentarily abolished during activity."

"This depolarization produces electric disturbances which go by the name of action potentials."

DISEASE	GENERAL IRRADIATION	LOCAL IRRADIATION
Neuritis	1st degree erythema to whole body in rotation, if general condition indicates	Chronic neuritis e.g. sciatica, may sometimes respond to 3rd degree erythema along course of nerve
<i>Skin diseases</i>		
Boils and carbuncles	1st degree erythema to whole body to raise resistance, as above	2nd to 3rd degree erythema until lesions either abort or exude pus. Thereafter 2nd and 1st degree doses to promote healing
Psoriasis and chronic eczema	As above if indicated	3rd degree erythema, doses reduced to 2nd and 1st degree as healing proceeds
Alopecia	1st degree erythema to whole body in rotation, as above	2nd to 3rd degree erythema to patches twice weekly increased by 1 min. at successive weeks until new hair is observed. Thereafter reduce to 1st degree
Acne		2nd to 3rd degree erythema repeated twice weekly. Infra-red rays for 10-20 min. sometimes achieve better results

ELECTRO-DIAGNOSIS

Although the interpretation of muscle action due to electrical stimulation is better left to the expert who is continually observing these phenomena, mention may be made here of this subject as a guide to the type of case in which help may be obtained with regard to the diagnosis.

Lower motor neuron injury or disease.—The term reaction of degeneration (R.D.) applied to muscles whose nerve conduction has been destroyed or impaired is well known; this sets in from ten to fourteen days after the injury or disease is established. In *complete R.D.* no response can be elicited in the muscle by stimulation with the faradic current of such strength as is tolerable to the patient. In *partial R.D.* a response can still be produced with the faradic current. In both cases the interrupted galvanic current will produce a movement in the muscle fibres which is altered from the normal in that, instead of a brisk contraction and relaxation of equal duration, a slow wavy movement is produced which is more marked in the relaxation than in the contraction. In *absolute R.D.* there is no response to either faradic or interrupted galvanic stimulation, as it occurs only in those cases of long standing in which the muscle and nerve fibres have completely degenerated.

Upper motor neuron injury or disease.—No appreciable difference from the normal reactions can as a rule be discerned, although in recent cases there may be a slight hyperexcitability noticeable with both types of stimulation.

Hysterical paresis or paralysis.—The reactions are normal, but by employing a strong faradic current voluntary response may be elicited owing to the patient's anxiety to withdraw from the painful stimulus. In the same way the faradic current can be used to diagnose or confirm a diagnosis of

sensory loss as hysterical. For instance, the patient is unable to appreciate the current perhaps in the hand and lower arm, but will volunteer the information that he or she can feel the current higher up the arm. One electrode, preferably a large one, is placed over the roots of the affected nerves as they emerge from the spinal canal, and the other electrode is stroked from the fingers up the arm until the current is felt. The exact place is then noted. Pressure with the finger is then made deeply at a point below this, and the patient is asked to concentrate on this spot. The electrode is again stroked from the fingers up the hand and forearm, and almost invariably when it reaches the spot where deep pressure has been applied the patient will confess to feeling the current. Pressure is again applied lower down the limb and the same procedure is repeated until in some cases the feeling all over the affected area can be restored at one "sitting". The condition is liable to relapse, but by daily repetition of the treatment will very soon be cured. Needless to say the diagnosis is obvious.

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Acne		2nd to 3rd degree erythema repeated twice weekly. Infra-red rays for 10-20 min. sometimes achieve better results

ELECTRO-DIAGNOSIS

Although the interpretation of muscle action due to electrical stimulation is better left to the expert who is continually observing these phenomena, mention may be made here of this subject as a guide to the type of case in which help may be obtained with regard to the diagnosis.

Lower motor neuron injury or disease.—The term reaction of degeneration (R.D.) applied to muscles whose nerve conduction has been destroyed or impaired is well known; this sets in from ten to fourteen days after the injury or disease is established. In *complete R.D.* no response can be elicited in the muscle by stimulation with the faradic current of such strength as is tolerable to the patient. In *partial R.D.* a response can still be produced with the faradic current. In both cases the interrupted galvanic current will produce a movement in the muscle fibres which is altered from the normal in that, instead of a brisk contraction and relaxation of equal duration, a slow wavy movement is produced which is more marked in the relaxation than in the contraction. In *absolute R.D.* there is no response to either faradic or interrupted galvanic stimulation, as it occurs only in those cases of long standing in which the muscle and nerve fibres have completely degenerated.

Upper motor neuron injury or disease.—No appreciable difference from the normal reactions can as a rule be discerned, although in recent cases there may be a slight hyperexcitability noticeable with both types of stimulation.

Hysterical paresis or paralysis.—The reactions are normal, but by employing a strong faradic current voluntary response may be elicited owing to the patient's anxiety to withdraw from the painful stimulus. In the same way the faradic current can be used to diagnose or confirm a diagnosis of

MANIPULATION IN GENERAL PRACTICE

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TREATMENT by manipulation of many chronic disabilities of the joints and spine, and of the locomotor system generally, is often of the greatest value in carefully selected cases. The time-lag in the recognition of its value has been due to a number of factors, one of the principal of which has been the bad results often attending manipulations by unqualified practitioners and which far outweigh their occasional successes. The clinical and pathological training that a qualified medical man receives should largely eliminate this objection. Another factor militating against the recognition of manipulative treatment has been the view that, owing to the acute reaction in the joint which is alleged to follow manipulation, more satisfactory results can be obtained by gradual methods, such as re-educational exercises, supplemented by physical treatment in such forms as heat, massage and electricity. Such methods are often of great value in minor cases of post-traumatic or rheumatic adhesions, or when used either as a preliminary or sequel to manipulation in more severe types of crippling. Exercises and physical methods have, however, their limitations; the practice of continuing with them indefinitely when progress is not being made and when residual stiffness might be speedily rectified by manipulation is not in the patient's best interests and is contrary to common sense. When the necessary knowledge and skill have been acquired, and with careful selection of cases, post-manipulative reaction in a joint is a rare phenomenon and this bogey should not therefore be raised as an argument against manipulation when the ideal time for this has arrived.

Every general practitioner should, in the interests of his patients (and indeed his own) make himself familiar with the types of case in which manipulative methods are of value. It is equally important that he should be acquainted with the types of case in which manipulation is definitely contraindicated. As a general rule, it may be stated that manipulative surgery is a highly technical subject and one not without disappointment and danger in inexperienced hands. This applies particularly to its use in the treatment of the stiffened and deformed joints occurring in the rheumatic forms of arthritis, and, indeed, applies to all cases of marked stiffness. That brilliant successes are possible is undoubtedly true; for instance, many patients who have been bedridden with arthritis for years can often be enabled to walk once more. What could be more interesting and indeed thrilling than the achievement of such results? Yet it is surprising to find

Now these action potentials can by amplification be conveyed either to a loudspeaker or to a photographic film or fluorescent screen. Suppose then that we wish to gain information as to whether a paralysed muscle is beginning to show signs of recovery, and that a few motor units (each nerve fibre supplies from 200 to 300 muscle fibres) are suspected of life, and yet this is undetectable by clinical or other methods, including those previously mentioned. Roughly, all that has to be done is to insert a needle, incorporating two electrodes, into the suspected muscle, when if there is any volitional activity in any muscle fibre, sounds, as Bauwens graphically described them, "ressemblant à un roulement de tambour voilé", will be emitted from the loudspeaker. As more muscle fibres "come to life" these sounds become more frequent and therefore afford valuable indications of returning nerve influx impulses to the damaged tissue. Denervated muscle fibres, on the other hand, produce another type of action potential easily distinguishable from these, and which results from spontaneous fibrillations.

In the last paragraph of his address, speaking of the electro-myograph, Bauwens states: "It deserves, in neurology, to take its place side by side with classic electro-diagnosis, and to supplement it without attempting to replace clinical examination".

CONCLUSION

The object of this article is to point out to the general practitioner the elementary fundamental principles of physics and physiology which underlie the treatment of disease by electrical methods. No mention has been made of the treatments of cavities, such as intra-pelvic ionization and diathermy, intranasal ionization, intra-aural ionization or eye treatment, as it is considered that these treatments are best left to a specialist. Whether these treatments are to be carried out in the practitioner's private rooms or be referred to clinics in charge of a specialist in physical medicine, is a point which must be decided by the individual practitioner concerned, or maybe the Government of the future may have some voice in this matter. Be this as it may, one obvious essential at the present time is the establishment of a London School of Physical Medicine and later subsidiary schools attached to each University in the country where postgraduate teaching in the whole subject of physical medicine and rehabilitation can be standardized and taught to those medical practitioners who are interested in the subject, and where further research can be carried out under ideal conditions. Only thus will electrotherapy progress.

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definitely established, a very large group of disabilities due to rheumatism and to infective conditions may be included.

(2) Dislocations and subluxations of joints, tendons and intra-articular discs, such as the semilunar cartilages of the knee joint.

(3) Cases of disability of some part of the locomotor system in which a psychoneurotic factor either constitutes the sole factor or, which is much more common, is implanted to a variable degree upon the organic factors mentioned in 1 and 2.

ADHESIONS

Manipulation is of the greatest value when the normal range of movement of the joint is restricted to a slight or moderate degree by adhesions, and in which the usual methods of physical treatment, including heat, and active and passive movements have proved of no avail. Cases of marked limitation of movement are, as a rule, unsuitable for manipulation, although sometimes considerable improvement may result from doing a little at a time in a carefully planned series of manipulations. In doubtful cases a preliminary examination under anæsthesia is indicated.

Diagnosis.—The most characteristic signs and symptoms of articular or periarticular adhesions are (a) limitation of certain movements of the joint associated with pain, (b) recurrent joint effusion, and (c) wasting of the muscles that move the joint. There is often also localized tenderness at the site of the adhesions if the capsule or periarticular structures are involved and deformity may be present. Traumatic adhesions, unless generalized, often give rise to limitation of some particular movement, whereas the other movements of the joint may be comparatively free. Cases are frequently seen in which flexion of the knee is restricted whilst extension and rotation are complete. After a sprain of the external lateral ligament of the ankle, inversion may be the only movement that is restricted; pain in tennis elbow can often be elicited by a combination of extension and pronation of the forearm with flexion of the wrist. Slight degrees of limitation of rotation of the shoulder or knee may easily be overlooked. In cases of arthritis or peri-arthritis, there is usually a limitation of all the movements of the joint, although the brunt of the limitation may fall upon some particular movement. In testing the movements of joints, such as the shoulder and hip, it is most important to fix the scapula and pelvis, respectively; otherwise scapular or pelvic movement may mask a marked degree of limitation of movement in these joints.

Prevention of adhesions.—A large number of cases of adhesions in connexion with joints, muscles, tendons and their sheaths are caused by a too rigid application of the doctrine of rest to injuries and diseases of joints or of structures in their vicinity. This particularly applies to fractures. On the other hand, *excessive* movement may increase the tendency to

how often these patients have been told, even by eminent physicians, that nothing more could be done, and it is disappointing to observe the disproportionate interest that is often taken in other spheres of orthopædic work, such as fractures. Such excellent results from manipulative treatment are a great advance when we consider that, until comparatively recent times, textbooks of medicine universally condemned manipulation in arthritic deformities. These textbooks usually inveighed against "forced movement", a term to them synonymous with the act of manipulation and which suggests the reckless application of violence with the minimum of skill by a person with the muscular development of a coalheaver or stevedore! A skilled manipulator uses very little force but, as it were, gently coaxes the movement back to the stiffened joint. Good results, however, can only be achieved by those who have had a long period of training, and are impossible without team work, patience and perseverance, and a spirit of cheerful optimism by all concerned, especially on the part of the patient.

All these factors constitute so many links in a chain. Given that the case is suitable for manipulation, there is the skill and personality of the surgeon, the technique of the actual manipulation, the skill of the anæsthetist in procuring adequate muscular relaxation, the patience and perseverance of the patient, the suitability of the after-treatment, and the skill and psychological aptitude of the physiotherapist. If one or more of these links should prove defective, complete success may be impossible and if a link snaps completely, unmitigated failure may result. It will therefore readily be understood that to regard the whole art of manipulation as the forcing of a joint through its complete range of movements (as is sometimes alleged even by orthopædic surgeons) and then leaving the patient to his own devices is one that is apt to bring a valuable method into disrepute.

Many of the post-traumatic forms of stiffness and disability of joints due to the presence of adhesions or scar tissue may also be benefited by manipulation. Here again, many of these manipulations are difficult and not without danger in inexperienced hands. Nevertheless, there are certain manipulations which the general practitioner is perfectly justified in performing. It is probable that having achieved success in certain minor forms his interest and enthusiasm will be aroused and he will seek the necessary fields of training and experience.

CLASSIFICATION

Cases that may be benefited by manipulation may be grouped as follows:—

(1) Stiffness, pain, and other disabilities of joints resulting from the presence of articular or periarticular adhesions. These may be due to injuries, and follow traumatic synovitis, contusions, ligamentous, muscular or tendinous sprains and fractures; or they may be due to toxic or microbe infections. In the latter group, although the cause of rheumatism is not

adhesion formation. Both rest and movement play important parts but the minimum resulting disability and crippling can only be achieved by their judicious combination. In cases of arthritis of the rheumatoid type, particularly when the joints of the lower extremity are involved and when the condition is active, as manifested by obvious clinical signs and by a raised sedimentation rate, rest in bed is of great importance, both on general principles and to relieve the joints of the strain of weight bearing.

The insidious tendency towards stiffness and deformity should, however, be ever present to the practitioner, and although it is often wise to apply plaster splintage to the affected joints in the optimum positions, the plasters should be removed for gentle active movements as soon as practicable. If this is not done an obstinate type of ankylosis is a common sequel. In ultra-acute cases, this may be the best that can be hoped for and care must therefore be taken that ankylosis, if inevitable, occurs in the optimum position. An obstinate type of stiff knee is particularly apt to follow uninspired treatment of the fractured femur, and good results are perfectly compatible with early movements of the knee. Such movements can eliminate this frequent sequel of a fractured femur.

Differential diagnosis.—There are certain contraindications to manipulative treatment of a joint stiffened by adhesions. Tuberculous disease, in particular, is one type of stiff joint in which no benefit can possibly result; in fact, such treatment may be followed by disaster. A joint which is the seat of active tuberculous disease presents signs, symptoms and history which usually make the condition fairly obvious. A monarticular arthritis in a child should always arouse suspicion. In the more chronic types, however, when the active disease has died down and left a stiff and deformed joint, diagnosis may be more difficult and the condition may be mistaken for one of the rheumatic or even a traumatic form of arthritis. In such cases, in addition to the routine careful clinical investigation and the use of special tests, X-ray examination often furnishes valuable information and should never be omitted. Muscular wasting is usually a particularly prominent feature in the tuberculous joint, and the scars of old sinuses may be present. Thorough examination of the patient is necessary, as tuberculous disease of a joint is nearly always secondary to active tuberculosis elsewhere.

DISLOCATIONS AND SUBLUXATIONS

This group contains many important conditions encountered in general practice. By far the most familiar of these are lesions of the semilunar cartilages of the knee joint. For such conditions, and particularly when they give rise to mechanical interference with the normal movements of the joint, manipulation is often necessary, at any rate as a preliminary measure. The commonly used term "displaced cartilage in the knee" is a half-truth, as in practically every case the semilunar cartilage is split, and the locking

In manipulation for fracture-dislocations of the external semilunar cartilage, the technique differs in that the leg is adducted to open up the *outer* side of the knee joint and, at the end of extension, the tibia is firmly rotated *outwards*.

Subluxations are displacements at a joint not amounting to a complete

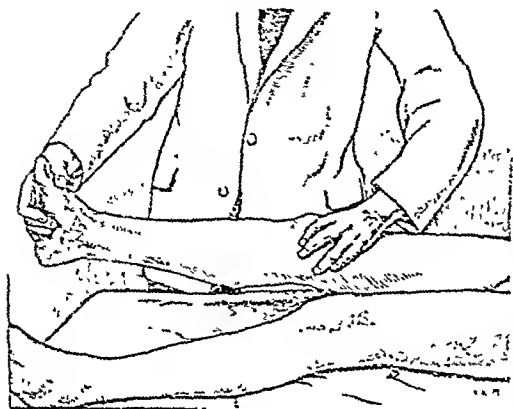


FIG. 3

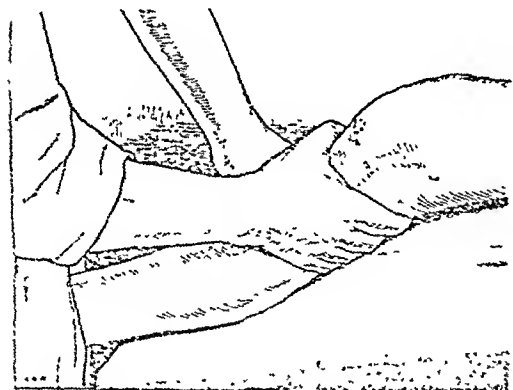


FIG. 4

dislocation. Although common in many other types of joint, these are most often encountered in the arthrodial type of diarthrosis, when two comparatively flat surfaces are in apposition. As an example, the acromioclavicular joint may be cited. If the capsular ligament of this joint alone is torn, a subluxation may result. If, however, the stronger ligaments connecting the acromial end of the clavicle to the coracoid process of the scapula be ruptured, a true dislocation results. In many cases of sacro-iliac strain there appears to be a slight rotatory shift of the ilium upon the sacrum and good results follow manipulation. Other examples of subluxations benefited by manipulation are those which may occur at the intercarpal

and intermetacarpal joints and between the articular processes of the vertebrae, particularly in the neck.

PSYCHONEUROTIC CONDITIONS OF THE JOINTS AND SPINE

In cases of marked neurosis it must be remembered that the symptoms are often a manifestation of some deep-seated psychological condition which requires sympathetic treatment. It is often possible to cure the spinal or joint condition but, so long as the patient's goal remains the same, when one symptom is given up another is often found. Such patients become "vir-

joint (fig. 2). In those cases in which the back part of the internal semilunar is torn and displaced, reduction may occur at this stage. Next, the knee is slowly extended, and during this movement, rotation inwards and outwards plus abduction is continued. The final movement of extension is very important and is accompanied by a forcible movement of internal rotation—the so-called "screw-home" movement which normally accompanies the final stage of extension (fig. 3).

METHOD 2:—In obstinate cases, the patient's knee is flexed at an angle of about 20° over the end of the operation table or couch, and the surgeon, sitting or standing opposite, grips the lower part of the patient's leg between his thighs and grasps the head of the tibia with his hands in the manner shown in the diagram (fig. 4). Next, he uses the thigh grip to abduct the tibia and open up the inner side of the joint and simultaneously and forcibly rotates the head of the tibia inwards and outwards with his hands. An audible click or snap is evidence of the success of these manœuvres but this is more often heard in recurrent types; the absence of this sound does not necessarily mean that the operation has not been successful.

The success of the manipulation is made obvious by the fact that the block to full extension no longer exists. In primary cases, however, spasm and effusion may prevent the removal of the mechanical block from being so immediately manifest and striking as is usual in recurrent types. In the latter, the patient is usually an "old hand at the game" and may be the best judge of the success of the manipulation. He often learns some particular trick or movement by which he can himself unlock his knee joint. In such recurrent types removal of the damaged semilunar by open operation should be advised at the earliest possible moment, for otherwise osteoarthritic changes are apt to supervene in the joint. Although the results of this operation in Service patients during the recent world war have not always been satisfactory, in expert hands it should be one of the most gratifying in surgery.

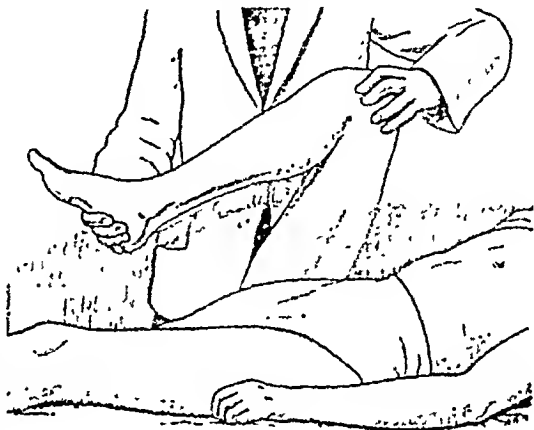


FIG. 1

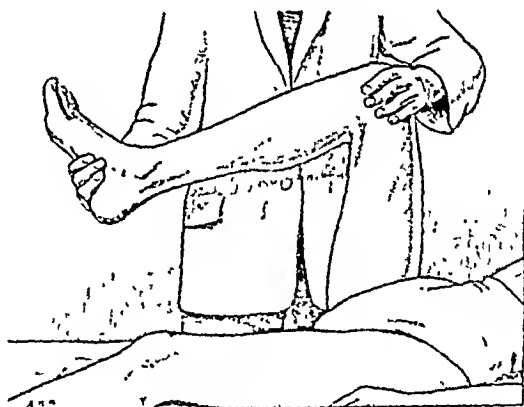


FIG. 2

anæsthetic such as intravenous pentothal is ideal for the purpose. Nitrous oxide is often disappointing.

A manipulation for minor or moderate degrees of traumatic adhesions, if properly performed, is usually followed by immediate relief from the pain on movement and the nocturnal aching previously present. It is necessary to mention this, as an impression exists that manipulations are followed by marked pain and reaction. In many cases of joints stiffened by adhesions, it is a wise precaution to restore the full range of movement by a series of manipulations separated by intervals. In this way, the reaction and re-stiffening that might follow an attempt to restore full movement by one operation can be avoided.

The increased range obtained after any manipulation must be consolidated by almost immediate re-educational exercises, which also gradually rectify any muscular wasting that may exist. Occupational therapy and rehabilitation by games of skill are often of great value.

In obstinate types of stiffness, as in many of the contracted joints of rheumatic disease, it is often necessary temporarily to retain the limb in the corrected position in plaster of Paris, which can, however, be removed for physical measures and re-applied at the end of each session.

Manipulations in cases of arthritis, including the rheumatic forms, should not be performed when there are clinical signs of activity in the joint and when the sedimentation rate is raised.

A surgeon or practitioner will spare himself many sleepless nights if he will always insist upon X-ray examination of the affected joint or of the spine before deciding to manipulate.

In stiffness of the elbow joint, following fracture or dislocation in young people, manipulation is contraindicated, owing to the risk of myositis ossificans.

No hard and fast rule can be laid down about the age factor and manipulation: *per se* it is not necessarily a contraindicating factor. It is obvious, however, that only extreme urgency justifies manipulation at any age when the general condition of the patient is poor and gives rise to anxiety.

I am indebted to Messrs. John Wright Ltd. for permission to reproduce the four illustrations from my chapter in Pye's "Surgical Handicraft".

tuosos of neurosis, continually extending their repertory" (Adler). Good results from manipulation, however, are often seen if the patient can be removed from harmful influences and simultaneously given a fresh, hopeful and cooperative outlook on life; otherwise, disappointment is inevitable. By manipulation the vicious circle may be broken in one place but may join again. If, however, it is broken at two or more places by a concentrated attack, this is unlikely. The cooperation of a psychologist should therefore be sought in difficult patients.

Such cases of what we may call the "classical" types of joint neurosis are infrequent when compared with the vast numbers of joint troubles in which there is a definite organic basis but with a superadded psychological factor. This combination is frequently encountered in injuries and diseases of the joints, and particularly in rheumatic joint conditions. It is apt to supervene when treatment has been uninspired, prolonged and disappointing, and a sense of frustration and lack of confidence results. These are the patients who, thoroughly disgruntled with doctors, rush off to osteopaths or bonesetters.

Good results can usually be achieved in the latter group by manipulation if the surgeon or practitioner and all concerned in the after-treatment have the gift of inspiring the patient with confidence and cooperation. Team work is the secret of success and a long course of after-treatment should be avoided, if possible, as this tends to refix the neurotic factor temporarily abolished by the manipulation.

SUMMARY OF GENERAL PRINCIPLES OF MANIPULATIVE TREATMENT

As has already been noted, but it will bear repetition, the cases of articular or periarticular adhesions that respond best to manipulation are those which have brought about a slight or moderate degree of limitation of movement, associated with pain and/or swelling, and which have failed to respond to ordinary methods of physical treatment. The art of manipulation does not consist solely in moving the joint through its full range of movement, as is sometimes asserted. There is a special technique for every joint and a famous bonesetter was not far wrong when he said "It's the twist that does it".

Success in manipulative work, except in quite minor cases, requires a long course of training and those indefinable qualities summarized by the term "hands". The knowledge of the types which are suitable for manipulation and of those in which it is contraindicated, or even dangerous, can also only be learned by experience. Most beginners make the mistake of using too much force. This is quite unnecessary, as the proper application of a moderate degree of force is the main desideratum.

Perfect muscular relaxation is necessary for the manipulation, and an

to the baths may be immediate or cumulative, general or local, according to the type of bath and length of treatment. Thus in balneotherapy the physician possesses a powerful weapon for modifying the reactions of the body.

EFFECT OF BATHS ON THE HUMAN BODY

- (A) General action: (i) Sedative
(ii) Stimulating
(iii) Thermal
(iv) Pressure
(v) Anti-gravity
- (B) Local action: (i) Relief of pain and stiffness
(ii) Relaxation of muscle
(iii) Absorption of inflammatory products

GENERAL ACTION

Sedative action.—When the body is immersed in still water of indifferent temperature [93° F. (37° C.)], that is to say, a temperature at which heat is neither lost nor gained by the surface of the body, a sedative action is produced, for the baths protect the surface of the body from all stimuli, including thermal stimuli. Prolonged thermal baths are capable of producing sleep in difficult cases of insomnia. They also allay the excitement and restlessness due to nervous and mental overstrain, as well as in cases of more serious mental disorder. Thus many homes and hospitals for mental diseases are equipped with sedative baths. Hot baths have also a sedative action, although the immediate effect is that of stimulation. After a very short time the heat of the water spreads through the body tissues, the muscles relax and sweating increases, causing a sedative action. This explains the action of the hot bath taken before going to bed for the purpose of inducing sleep and relieving muscle stiffness. This sedative action of hot water is most useful in reducing the spasticity of the muscles in cases of paraplegia when movements are attempted in the deep bath.

Stimulating action of baths.—Short immersion of the body in still water, at a temperature below 90° F. (32.2° C.), causes a contraction of the superficial blood vessels. This stimulates the vagus centre by reflex action, and causes slowing of the pulse and deeper respirations. The heat-regulating centres are also stimulated, causing an increase in heat production. Fortescue Fox (1924) states that this is brought about principally by the combustion of fats. When a cold bath is unduly prolonged the production of heat fails to keep pace with the loss, and stimulation is followed by exhaustion. In actual practice the use of cold baths is always combined with either exercise, massage, or douching. Percussion effects, by using douches of variable pressure, act as a stimulant to the circulatory and nerve-endings. The effects can be modified by using nozzles of different shapes, and different water pressure. One of the strongest stimulants for improving tone and circulation is the contrast of heat and cold, applied in

THE RÔLE OF BALNEOTHERAPY IN REHABILITATION

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BALNEOTHERAPY is that branch of therapeutics which deals with the use of baths in the treatment of disease. It is a subdivision of hydrotherapy, which includes the use of water internally as well as externally. Balneotherapy is one of the oldest forms of physical treatment, and for many years was practised almost exclusively at spas, where it is claimed that the natural mineral waters possess specific curative effects not possessed by baths of simple water. This may be true in some instances, but the general opinion is that a large part of the beneficial effect of baths is due, not to dissolved minerals or radio-activity of the water, but to the physical and thermal action of the baths. In the last twenty years, baths of simple water have been installed for therapeutic use in general hospitals, rheumatic clinics, seaside resorts, and mental hospitals. An increasing number of authorities consider that a therapeutic pool is an essential item of equipment in orthopaedic centres and departments of physical medicine.

Heald (1944) points out that in the strict sense of the word rehabilitation begins with the first attendance of the practitioner; in actual practice the word is generally taken to mean the final process which enables the patient to return to his usual occupation. Thus in a case of fracture in the region of the shoulder the orthopaedic surgeon has done his work, the fracture is healed in good position; but in some cases stiffness and inability to use the arm prevent the patient from doing his work. This is where balneotherapy is of outstanding use; a short course of manipulation and douching in the therapeutic pool may shorten the period of convalescence by a month or so. There are many chronic conditions following injuries or illness in which balneotherapy removes the final disablement or at any rate shortens the convalescent period.

PRINCIPLES OF TREATMENT

The chief value of baths for the purposes of rehabilitation lies in (1) the physical and thermal action of water on the skin and through the skin on the underlying blood vessels, nerve-endings, sweat glands and muscle; and (2) the elimination of the action of gravity: water, by supporting the weight of the limbs, is an ideal medium for moving stiff and painful limbs.

The skin contains more capillaries and more sensory nerve-endings than any other part of the body. It is the principal heat-regulating organ, and is especially equipped to react to external stimuli. Baths are a convenient and easily controlled means of applying external stimuli, and thus affect indirectly the nerve centres, circulation and metabolism. The reactions

area. The application of mud and peat packs is particularly valuable for this purpose.

Relaxation of muscle spasm.—The optimum temperature for relaxation of muscular spasm is 102° F. (38.9° C.), and the relaxation thus produced not only relieves pain and stiffness but is valuable for the purposes of manipulation.

Absorption of inflammatory products.—Increased flow of blood to the affected area is brought about by the heat of the water, or mud-pack, and the under-water douche, at a temperature of 104° F. (40° C.), carefully applied, leads to the absorption of inflammatory fluid. The douche should only be used in cases of chronic thickening or œdema, following an old fracture or septic wounds. The whirlpool bath is particularly useful in these cases.

BATHS OF PARTICULAR USE FOR REHABILITATION

- (1) Therapeutic pool
- (2) Aerated immersion
- (3) Whirlpool
- (4) Contrast bath

The manipulation or therapeutic pool resembles a small swimming bath; it should be not less than 12 ft. wide and 20 ft. long, with a depth of about 4 ft.

Across the bath, at a level of 3 ft. from the floor, are two parallel metal bars. In a fully equipped bath there is a canvas stretcher attached to a gantry, by means of which cripples can be swung over the bath and lowered into it (fig. 1). An under-current douche is provided. A skilled attendant is in the bath to manipulate stiff joints, and give passive movements. The patient holds on to the two bars while being manipulated. After manipulation the attendant assists the patient to carry out swimming movements in the pool, and directs the prescribed exercises. A few minutes before the patient leaves the bath, the undercurrent douche is played on the manipulated areas or affected muscles. This has an analgesic effect and takes away much of the discomfort caused by the stretching. After the bath the patient is wrapped in warm blankets.

This bath is expensive to build, and the running costs are heavy: in many institutes a smaller and inexpensive tank has been installed (the Hubbard tank). This is shaped something like a figure-of-eight, so that there is just room for full abduction of the limbs. The technician stands outside the bath, and can assist movements if necessary. The temperature of the water advocated by certain American physicians is 90° to 96° F. (32.2° to 35.6° C.). This temperature seems to me to be too cold for full muscle relaxation.

Too frequent or too prolonged courses of the bath may lead to thermal debility, for the temperature of the body is raised 2 or 3 degrees after full immersion in water above 100° F. (37.8° C.), and subsides slowly. Thermal debility is a condition in which the patient suffers from lassitude, depression, and general malaise, not unlike the condition which develops after severe influenza. Mathew Ray (1940) aptly remarks:—

“The therapeutic pool supplies something more than massage, movements and electrical treatment, because the patient, when he finds that movements which were

the form of douches of varying temperatures, as in the Scotch douche, or by immersing the limb alternately in basins containing hot and cold water. Tennis players have found that the needle douche, beginning at 103° F. (39.4° C.) and gradually lowered to 60° F. (15.5° C.), is an excellent stimulus after an exhausting set, and enables the player to play the next match with renewed vigour.

Thermal action: (a) production of artificial pyrexia.—When a patient is fully immersed in water above the temperature of 100° F. (37.8° C.), loss of heat by evaporation, radiation and conduction is inhibited, causing a rise of body temperature. This rise of temperature increases metabolic activity, breathing becomes deeper, and there is corresponding increase in the intake of oxygen and elimination of CO₂. The amount of sweat is largely increased, particularly if the patient is packed in hot towels after the bath. This artificial pyrexia is part of the explanation of the value of baths in the treatment of rheumatism, and metabolic diseases such as gout and obesity.

(b) Sweating is another result of the thermal action of water.—As shown above, full immersion in the thermal bath produces a free perspiration, but hot vapour baths are more convenient to use for this purpose. In this bath little reaction in the form of artificial pyrexia occurs, as a certain amount of evaporation takes place from the skin during the bath.

Pressure effects.—In a deep bath the weight of the water exerts pressure on the superficial veins. Gordon and Thompson (1929) point out that in the case of a patient sitting immersed to the neck in a bath 1.2 metres deep, the average hydrostatic pressure on the surface is that of a column of water 60 cm. deep. As the venous pressure is 5.15 cm. of water at heart level, it is obvious that the mass effect of the weight of water in the bath must be considerable in promoting the passage of blood through the deeper veins. Pressure effects are accentuated by massage and douching, and these methods, used separately or combined, promote a rapid and free circulation through the skin.

Anti-gravity effect.—When the body is immersed in a deep bath the action of gravity is eliminated to the extent of about 90 per cent. Thus, far less muscular effort is required to move the limbs, and movements quite impossible in the air may be possible in water, especially if the temperature of the water is 101° to 102° F. (38.3° to 38.9° C.), for at this temperature muscular spasm, contraction, and hypertonus are reduced. Active and passive movements can be carried out with less discomfort, and a greater range of movement is possible. This leads to re-education of the disused muscles, and encourages the patient to make greater efforts to carry out active movements.

LOCAL ACTION

Relief of pain.—This is brought about by dilatation of the superficial capillaries, thus relieving the congestion in the deeper blood vessels, and also by the analgesic action of the undercurrent douche in the inflamed

area. The application of mud and peat packs is particularly valuable for this purpose.

Relaxation of muscle spasm.—The optimum temperature for relaxation of muscular spasm is 102° F. (38.9° C.), and the relaxation thus produced not only relieves pain and stiffness but is valuable for the purposes of manipulation.

Absorption of inflammatory products.—Increased flow of blood to the affected area is brought about by the heat of the water, or mud-pack, and the under-water douche, at a temperature of 104° F. (40° C.), carefully applied, leads to the absorption of inflammatory fluid. The douche should only be used in cases of chronic thickening or œdema, following an old fracture or septic wounds. The whirlpool bath is particularly useful in these cases.

BATHS OF PARTICULAR USE FOR REHABILITATION

- (1) Therapeutic pool
- (2) Aerated immersion
- (3) Whirlpool
- (4) Contrast bath

The manipulation or therapeutic pool resembles a small swimming bath; it should be not less than 12 ft. wide and 20 ft. long, with a depth of about 4 ft.

Across the bath, at a level of 3 ft. from the floor, are two parallel metal bars. In a fully equipped bath there is a canvas stretcher attached to a gantry, by means of which cripples can be swung over the bath and lowered into it (fig. 1). An undercurrent douche is provided. A skilled attendant is in the bath to manipulate stiff joints, and give passive movements. The patient holds on to the two bars while being manipulated. After manipulation the attendant assists the patient to carry out swimming movements in the pool, and directs the prescribed exercises. A few minutes before the patient leaves the bath, the undercurrent douche is played on the manipulated areas or affected muscles. This has an analgesic effect and takes away much of the discomfort caused by the stretching. After the bath the patient is wrapped in warm blankets.

This bath is expensive to build, and the running costs are heavy: in many institutes a smaller and inexpensive tank has been installed (the Hubbard tank). This is shaped something like a figure-of-eight, so that there is just room for full abduction of the limbs. The technician stands outside the bath, and can assist movements if necessary. The temperature of the water advocated by certain American physicians is 90° to 96° F. (32.2° to 35.6° C.). This temperature seems to me to be too cold for full muscle relaxation.

Too frequent or too prolonged courses of the bath may lead to thermal debility, for the temperature of the body is raised 2 or 3 degrees after full immersion in water above 100° F. (37.8° C.), and subsides slowly. Thermal debility is a condition in which the patient suffers from lassitude, depression, and general malaise, not unlike the condition which develops after severe influenza. Mathew Ray (1940) aptly remarks:—

“The therapeutic pool supplies something more than massage, movements and electrical treatment, because the patient, when he finds that movements which were

difficult have become easy under water, is encouraged in his determination to persevere in his efforts."

As an illustration of the value of the therapeutic pool built by the Bath Corporation, it may be mentioned that on an average sixty treatments



FIG. 1.—Canvas stretcher for lowering crippled patients into the hot pool at Bath.

are given every week. Twenty to thirty of these are cases from the Bath and Wessex Orthopædic Hospital.

Aerated immersion.—In this bath, air is forced by compressed steam into a deep immersion bath under the surface of the water and emerges as a number of bubbles, which produce the effect of mild percussion on the skin, and, as air is a non-conductor of heat, it reduces the discomfort of a cold bath. The bath is generally prescribed at a temperature varying from 90° to 98° F. (32.2° to 36.7° C.). The subthermal bath slows the pulse, and the percussive action of the air-bubbles stimulates the superficial circulation. This is a somewhat similar action to that of the Nauheim baths,

in which the percussive effect is caused by CO_2 gas. It is the general opinion that the CO_2 gas acts physically, and not chemically. A word of warning is necessary here. The compressed steam which forces the air into the bath sometimes mixes with the air in the bath; thus the temperature of the water may be gradually raised well above 100°F. (37.8°C.). To a debilitated patient a thermal bath will do more harm than good, particularly in functional heart cases.

The whirlpool bath (fig. 2) resembles a deep basin, large enough to cover the legs or forearms. The water is violently agitated by a turbine under the



FIG. 2—The whirlpool bath.

water, and the motion of the water against the limbs acts as a form of massage. The temperature of the water is considerably higher than that used in the aerated immersion. This bath is easier and less expensive to work than the aerated bath.

The contrast bath consists of two large basins, one filled with hot water at a temperature of 104° to 108°F. (40° to 42.2°C.) and the other filled with cold water at a temperature of 40° to 60°F. (4.4° to 15.5°C.). The limb is first plunged into the hot water for a period of one to two minutes and

then into the cold water for one to half a minute. This is repeated five or six times. Treatment must start and end in the hot bath. This bath is useful in cases of sprains around the ankle or wrist, or for the swelling of the legs which follows long-continued standing. This is one of the few treatments which can easily be carried out in the patient's house.

DISEASES AND INJURIES SUITABLE FOR REHABILITATION BY BATHS

Traumatic conditions of bones and joints.—The therapeutic pool is useful in treating the after-results of fractures, particularly of the femur, when the patient has had to lay up for some time. The muscles have become stiff and there is a certain amount of thickening around the site of the fracture. Injuries of the shoulder joint are particularly liable to lead to stiffness, and treatment in the pool should be started as early as possible. For the œdema and stiffness following fractures in the region of the wrist or ankle, the whirlpool bath is indicated. The temperature should be at least 106° F. (41.1° C.) and the treatment should be carried out for fifteen minutes.

In cases which have been manipulated under an anæsthetic, adhesions tend to reform unless active movements of the joint or muscle are carried out very soon after the manipulation. These active movements are far easier and less painful in the pool, and may be assisted by the attendant if desired. The undercurrent douche, at a temperature of 104° F. (40° C.), is played on the affected area after the stretching, and does much to relieve the discomfort.

Neurological conditions.—In the after-treatment of poliomyelitis the pool is most valuable. The weak and paralysed limbs are supported by the water, and the heat, 100° to 102° F. (37.8° to 38.9° C.), leads to the relaxation of the contracted muscles, thus allowing voluntary movements quite impossible in the air. If necessary these movements can be assisted by the attendant, and contractions overcome. The patients are encouraged to swim, and even if they cannot do so the attendant, by holding up the chin, may teach them to go through the movements; this has a valuable psychological effect. Paraplegia and partially paralysed limbs may be treated on the same lines. The sedative action of the warm water diminishes the tendency to spasm, and relaxes the muscles. In many of these cases there is defective circulation in the affected limbs, which are cyanosed and cold. For this condition the whirlpool bath is an excellent treatment.

Rheumatic conditions.—In osteoarthritis of the hip it is often possible to overcome some of the flexion deformity and contraction of the adductor muscles in the pool. After the manipulation the patient must make efforts to swim, assisted, if necessary, by the attendant in the water. The frog-like actions of the legs in swimming are exactly the movements required for stretching the muscles supplying the hip joints, especially the adductors.

The average case of rheumatoid arthritis does not do well in the therapeutic pool, owing to the early onset of general fatigue. On the other hand,

the aerated immersion temperature, 94° to 96° F. (34.4° to 35.6° C.), acts as a stimulant, and the percussion action of the bubbles assists the superficial circulation. The whirlpool is useful for treating stiff and swollen joints of the feet and hands. When the disease has lost its activity, and the sedimentation rate is normal, or nearly so, manipulation in the pool is justifiable.

Fibrositis.—Full immersion in the pool, at 102° F. (38.9° C.), relaxes the muscles; the heat encourages the superficial circulation and the action of swimming loosens the affected muscles. Loss of heat by evaporation, radiation and conduction is inhibited, causing a rise of body temperature which increases metabolic activity, and is particularly useful in cases in which the fibrositis is associated with gout or obesity. After the bath the patient is wrapped in hot blankets, and sweats profusely; this is beneficial in the overweight type of patient. The underwater douche is particularly useful in cases of fibrositis when played on the affected area. By altering the pressure, temperature and the distance of the nozzle from the patient the effect can be so graded that the application is painless.

Debility following illness.—The aerated immersion at a temperature of 94° to 96° F. (34.4° to 35.6° C.) has a general tonic action for convalescent patients who have recently suffered from severe febrile illness. The feeling of well-being which follows the bath hastens their recovery.

In conclusion it may be said that properly equipped baths of simple water are a most efficient weapon for the rehabilitation of many chronic cases, medical and surgical, and only the lack of the necessary apparatus prevents the more extensive use of balneotherapy.

SUMMARY

(1) Balneotherapy is the treatment of disease by the external use of water in the form of baths and douches.

(2) Baths are a convenient and easily controlled means of applying external stimuli to the skin, and thus affect the nervous system, circulation and metabolism.

(3) Therapeutic effects include the relief of pain, relaxation of muscle, and absorption of inflammatory products. Water supports the weight of the limbs by counteracting gravity, and baths are useful for the movement of stiff joints and limbs with weak, or partially paralysed, muscles.

(4) Types of baths especially useful for purposes of rehabilitation are:—(1) the therapeutic pool; (2) aerated immersion; (3) the whirlpool, and (4) the contrast bath.

(5) The conditions in which baths are of particular value are:—(a) after-treatment of bone and joint injuries; (b) poliomyelitis, paraplegia and partial paralysis; (c) various rheumatic diseases, and (d) debility following long febrile illness.

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skeleton and muscle with their connecting tissues. Increase of strength is associated primarily with the hypertrophy of muscle. Strengthening exercises are those which require maximum slow contraction of muscle, frequently against resistance. Endurance is a measure of the ability to balance catabolic with appropriate anabolic processes, and as such it means a sufficient supply primarily of oxygen and secondarily of food. Thus the coordinated work of the circulatory, respiratory and alimentary systems is of main importance here, this coordination being due to the nervous system, particularly the autonomic portion, and the endocrine system. Endurance exercises are those needing prolonged effort. Skill is largely a matter of the control of the central nervous system over the skeletal muscles. "Perfection of movement is the most prominent result of training. It is also the most specific" (Steinhaus, 1933). Exercises of skill are those requiring any movement of dexterity with the ultimate acquisition of precision.

These short notes on general training principles and on the purpose of exercise should allow us to consider athletic failures against the background in which they occur.

PHYSIOTHERAPEUTIC PRINCIPLES

Before dealing with physiotherapy as such, the point should be stressed that there are definite limitations to its usefulness: it is not the panacea for all aches and pains. Too often patients are advised to continue treatment after its efficacy has finished. Honesty and courage are needed in deciding the limitations to treatment. Only so can the present congestion in physiotherapy departments be overcome, leaving more scope for the proper treatment of those with reasonable prognosis.

Some mention will next be made of the techniques of treatment and, as previously, elementary principles are stressed.

Rest.—The first physical treatment to be considered is *rest*: this can be general or local. It is probably prescribed more frequently than any other therapeutic measure, yet in many instances no detailed instructions are given and there is a natural tendency to err on the side of safety. There has, however, been a wide break away from the traditional doctrine of long rest, a faulty outcome of the teaching that "repair is but the repetition of growth" and "rest is the necessary antecedent to the healthy accomplishment of both repair and growth" (Hilton, 1863). Too great emphasis had been put on rest, however, for Hilton rightly maintained that "activity and rest, alternating and in due relation to each other, form the physiological basis of, and key to, health in man . . ." It is the proper proportion already mentioned under the principles of training which must be stressed. Pain is not always the sole deciding factor in their timing; it is a subjective symptom which requires accurate assessment of the personality of the patient in conjunction with the presence of objective physical signs. After injury, rest should be only enough for the physiological subsidence of the

PHYSIOTHERAPY AND THE ATHLETE

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IN this article physiotherapy is defined as treatment by natural means, as opposed to drugs and surgery. These include rest, movement and massage, heat and cold, light and electricity, and water. An athlete is defined in the original Greek conception as one who takes part in any contest or struggle (C.O.D. 1931—competitor in physical exercises); it is not interpreted in the narrow sense of a track or field athlete. Competition with its emotional urge and its intellectual control is essential to the conception of an athlete.

In its broadest sense the subject could be taken to embrace the complete training of a competitor in any sport or game, and should include a dissertation on training as well as on all injuries and diseases. This is of too wide a scope for discussion here, and the practitioner comes in professional contact mainly with those whose training has for one reason or another failed. The more serious of these failures, such as fractures of bones, severe sprains of joints, badly torn muscles or nerves, or cerebral concussion, should pass immediately into specialist hands; but a host of lesser failures remains with the practitioner and is the source of much sick wastage with time lost from competition.

TRAINING PRINCIPLES

These minor breakdowns are best treated if their etiology is kept in mind, and for this the general principles of athletic training will be reviewed. It is realized that these are physiological truisms, but it is hoped that their necessary repetition will be condoned. Training consists primarily in the building up of the body for a specific purpose by the natural means of food, rest and exercise, each in different proportions for each individual; in other words, it is an individual prescription with three main constituents. It is, however, in the last of these, exercise, that most variability exists; it is exercise which is the precipitating cause of the majority of the physical breakdowns.

By exercise in athletic training we imply the use of the body more strenuously and for longer periods than in normal life. This entails the expenditure of energy and must be governed by moderation, progression and regularity. Its purpose is the development of the three interrelated powers of strength, endurance and skill, with the ultimate object of allowing the individual to compete more efficiently in physical exercises. Although all the tissues of the body are concerned, physiologically these powers may be considered to derive their main properties from different systems with an interlocking division of responsibilities. Strength is largely a property of

thing is that the effect is thermal only; it is not due to any specific emitters or special properties from different sources. Heat may be applied by conduction, convection or conversion; conducted heat being used when the body is in direct contact with a heated object, convected when the heat is thrown on to the surface from an outside source, and converted when it is developed in the tissues because of the resistance they offer to the passage of currents of high frequency. The sources may therefore range from superficial heat by hot fomentations, mud and wax applications, heated pads or cradles and lamps of all kinds, to deep heat by various forms of electricity, such as long or short wave diathermy. The source used is determined by the degree and depth of heat required, as well as by the practicability of its application. The physiological effects are due not to the source, but to the heat itself. The full physiological reactions to thermal changes are complex, but in general there is vasodilatation on heating and vasoconstriction on cooling, unless the cold be extreme.

Local application of cold is called for much less frequently than heat. It is used especially in traumatic lesions in which there is extravasation of blood and lymph. Its source is most commonly the cold water compress.

Light treatment is yet another form of physiotherapy in need of simplification. Light in the true sense is a form of radiant energy, and may be defined as that which renders objects visible to the eye. The term "light therapy" is used in connexion with ultra-violet, visible, and infra-red rays, although the first and last of these are invisible. The physiological effects of infra-red rays in sufficient quantities are those of heat. The ultra-violet rays have an actinic or chemical action; they are of proven use in such diseases as rickets, tetany, spasmophilia, lupus vulgaris and extra-pulmonary tuberculosis, but of much more doubtful value in the physiological maintenance of general health (Colebrook, 1946). The psychological effects of all kinds of light rays, together with the use of their names and the appearance of the source, appear to be boundless. The source of light and its accompanying heat ranges from the sun's rays through carbon arc and mercury vapour lamps to the simplest luminous heaters of the common household bowl type. They all contain rays in varying proportions and only the simpler sources are of physiological use to the practitioner.

Even more complex than light is *electricity* in treatment. Yet here too its main use is to produce heat, deep heat by conversion. Some degree of counter-irritation can be obtained by the use of the direct current. "The employment of various forms of electricity for therapeutic purposes has been unduly stressed by many physicians interested in physical therapy. There has been a tendency among some physical therapists to employ electricity to the exclusion of other physical methods of treatment" (Krusen, 1941). Although the forms of electrical current used in the treatment of disease are numerous, such as the constant or galvanic current, the faradic current, the various sinusoidal currents and the high frequency (diathermy)

inflammatory reaction of the injured part. It should be progressively mixed with activity to promote circulation and respiration and to encourage repair processes.

Exercise in its various forms is the next physical agent to be considered. Like rest it may be general or local. It may also be active or passive. Exercise is the most potent weapon in the armamentarium of physiotherapy, and the physiology of nerve and muscle with their coordination into one unit should be thoroughly understood. Especially important is the action of the nervous system in coordinating and controlling all bodily actions and functions, both voluntary and involuntary. Voluntary exercises performed by the patient himself have a greater effect on improving local circulation and building muscle, and are much safer than any passive manipulation by another person. In fact, passive movements have always an element of danger. Their performance should not be allowed by the non-medically trained, and their too frequent use, even by the practitioner, should be deplored. Active movements may be assisted, free or resisted, the assistance or resistance being afforded by the force of gravity, by weights and pulleys, or by a second person. Their value lies not only in their own contraction, but also in the physiological relaxation of the antagonists. Free, active movement is the type of motion imparted to a section of the body by voluntary contraction and relaxation of the muscles controlling the movements of that segment. No aid is given from external sources and the patient makes the entire effort at motion himself. It is this effort at motion which should be stressed, a central nervous factor which may result in peripheral action, for active exercise may be static or dynamic, depending upon whether or not actual movement at a joint takes place as a result of the contraction. Each in its place is of great value. Resisted active movements encourage maximum contraction with concomitant maximum relaxation of the antagonists. The effects of exercise include increased metabolism with all its physiological sequelæ.

Massage has been described as a systematic and scientific manipulation of the soft tissues. It may also be considered as applied passive movement, and as such is open to the same objections. However, correctly applied, both as regards time and technique, it has undoubted value. Its effects are both mechanical and reflex. Locally, especially if used after heat, it increases the circulation of blood and lymph and may stretch minor adhesions. Generally applied it is a soothing relaxing agent essentially personal in action, for the same effect can never be obtained by mechanical devices. Massage should be regarded as but a step towards active movements in which the patient's own muscles perform his own massage.

Local application of heat.—As heat is generated by muscle contraction, so its passive application is one of the most important adjuvants in physical treatment. For the practitioner this means local heat. It may be employed in many forms, dry or moist, superficial or penetrating. The important

are elevated. Protection, as by felt or rubber heel pads, and counter-irritation in its various forms are valuable in the gradual return to increasing activity. In all bone injuries, minor or severe, the sooner the athlete can be returned to full activity the less will his morale suffer.

Breakdowns at joints of all degrees from minor sprains to severe subluxations require physiotherapy. Upon the degree of injury diagnosed will depend the relative amounts of rest and activity. The practitioner is concerned chiefly with the minor injuries for which a short rest, postural and with local support, and relatively rapid return to movement are necessary. The importance of radiological exclusion of bony injury should not be forgotten, whilst symptomatic treatment by heat and massage is frequently valuable in the early stages. The joint most commonly injured is the knee, followed closely by the ankle. Accurate pathological diagnosis is necessary, for the knee is a particularly complicated joint anatomically and its treatment requires care and wide experience. Severe acute sprains are best referred to a specialist; minor ones are treated by twenty-four hours' postural rest with local cold applications and by gradual return to activity with the aid of firm local support. Passive physiotherapy should rarely be necessary if the support given is sufficient: firm immediately over the injured structure but yielding gradually over the rest of the joint. The secure strapping of knees, ankles and wrists is only learned by hard practice.

Recurrent acute and chronic sprains are those which cause most trouble and for which physiotherapy can do most. The former may best be aided by strengthening the muscles of the joint, ultimately by active resisted exercises; the latter primarily need rest, with local circulatory stimulation by heat in one of its various forms. One common chronic sprain of the knee is a traumatic inflammatory reaction of the infrapatellar pad of fat to frequent hard landings with the joint fully flexed. Its main treatment is removal of the exciting cause, but the subsidence of the enlarged tender pad may be materially assisted by the use of heat, superficial or deep, as by diathermy. Its prognosis is usually poor, however, and in recurrent and chronic conditions experience is necessary to assess realistically the chances of recovery and the activity ultimately possible; courage is necessary for the expression of this realism in prognosis.

The skeletal muscles and their tendons are the cause of much trouble to the athlete. The most common acute disabilities are the "pulled" and bruised muscles, whilst the chronic inflamed tendon is scarcely less so. If the pulled muscle can be treated immediately, the quickest return to activity is obtained by complete rest with cold compresses and local support for twenty-four hours; at the end of that time a gradual return should be made to activity. There is no call for local passive treatment, other than support in the early stages. Exactly the opposite is the case with the strained tendon, for which rest must be prolonged and, owing to poverty of circulation,

currents of long and short wave varieties, the details of their technical application do not concern the practitioner. The one exception to this is the use of the faradic current to stimulate weakened muscles; in the early stages this demonstrates to the patient that weak muscles are capable of good contraction, but it must not be allowed to take the place of voluntary effort. The basis of physiotherapy for the practitioner must be local heat and voluntary exercise.

Hydrotherapy may be considered as another form of heat treatment, although it involves mechanical as well as thermal stimulation. Its local application can be much used in the form of hot or cold baths or compresses, or of contrast bathing with alternate hot and cold water. Similarly, mud is used in some areas, whilst wax is a most useful form of applying moist heat, especially to the extremities.

This summary of the principles underlying physical treatment is necessary for the understanding of their application to the athlete.

FAILURES OF THE ATHLETE

His failures and breakdowns may present in many forms. It is not possible to consider them in detail but a few of the more common will be mentioned, as will outlines of their treatment by physical means. These physical means are aimed at assisting the body in its physiological recovery. Breakdowns are most easily thought of under the systems in which they occur. Although the anatomical structure and its physiological function are in the intelligent stable athlete the main limiting factors, man is a psychosomatic whole and his failures must be considered in relation to the whole man. Accurate diagnosis, upon which treatment and prognosis depend, therefore includes assessment of the individual as well as of his separate parts and their pathological condition.

Fractures.—In the skeletal system the most obvious breakdown is the fracture, in the treatment of which physiotherapy has its part. Rest is necessary for the union of the bone ends, but more important than perfect anatomical apposition is the full and rapid functional recovery of the overlying muscles with their enclosed circulatory and nervous tissues and of the adjacent joints. This requires early activity to assist bony union, maintain joint movement and ensure muscle function. Symptomatic physiotherapeutic measures, such as heat and massage, may be needed in the early stages, but cannot replace the essential value of rest and activity “alternating and in due relation to each other”. The importance of specialized supervision at fracture clinics cannot be over-stressed.

One of the more important of the minor maladies of athletes' bones is a *traumatic periostitis*, especially of shin or heel bone. The treatment consists mainly of rest, with avoidance of the exciting cause. The rest must be postural and may vary from bed rest to reduction of weight-bearing effort, remembering that rest to lower limbs is more effective when they

TWINS AND TRIPLETS, QUADRUPLETS AND QUINTUPLETS

SOME FACTS AND FALLACIES

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THE human female is characteristically monotocous, bringing forth but one young at a time. Since man and his domesticated mammals differ in this respect, to this variance a value has often been given. Man commonly has regarded himself as being superior to the animals he has tamed, and therefore his attributes, monotoccy among them, have by him been held to be better, higher, more god-like than theirs. For a human female to produce a veritable litter was therefore to behave like a beast and to merit censure.

Since it was customary for the human birth processes to yield a single child it followed that no man could possibly be the father of more than one at a time, and that any woman who gave birth to twins must have been unfaithful and was to be punished, together with the infant which her mate had not sired. Or one of the twins was the sequel of the visitation of an evil supernatural being and the mother was therefore accursed and had to be sacrificed along with one of the infants. The witch-doctor could readily distinguish between the legitimate and the unwelcomed.

In other times and places, but far less commonly, polytoccy has been regarded among primitive peoples as a manifestation of the blessing of the tribal god of fertility. Then the parental pair was to be honoured and the male could flaunt his fecundity with pride, and to the twins were ascribed supernatural powers and the possession of peculiar immunities.

These are representative samples of the notions out of which our present-day attitude towards human polytoccy have sprung. We are as interested as ever in the phenomenon itself but our reactions to the unusual have changed with the passing of time and with the modification of cosmologies. We fashioned the fears of our forebears into the salacious humour of the taproom. Nowadays, in civilized communities, multiple births arouse interest among the laity because they are exceptional, and because it is commonly reputed that between twins there is a peculiar mutual intimacy and interdependence. To them is ascribed the power of mental telepathy, since between them there is supposed to be this psychic bond, and their individual personalities are to a large extent merged into the unity that is the pair. Scientific investigation has supplied evidence which suggests that for these views there is some warrant.

The unique feat of successfully rearing every one of the Dionne quintuplets and the world-wide publicity that was released concerning them have lately given to multiple births generally an even greater news value. What almost amounts to an unofficial international contest appears to be taking place and the U.S.A. seems to be leaving nothing undone to break the record now held by Canada.

local stimulation by heat in all forms is desirable. One of the most resistant is the Achilles tendon, for which no treatment is so effective as prolonged rest from competition, relaxation by raising the heel in the shoe by sponge rubber, counter-irritation either physical or chemical, and deep heat by diathermy.

In the muscular system, one of the most difficult problems facing the practitioner is the older athlete who comes complaining of undue stiffness and aching; he wants to be as active and symptomless as in his younger days. Physiotherapeutic measures can be of great help to him, especially in the correct proportioning of rest and exercise in its various forms in his training. Swimming in warm water is a most soothing and relaxing exercise. Heat and massage too are valuable in aiding the circulation which age has decreased: but more valuable is the advice that although his desire for activity has not diminished, his physiological ability suffers with increasing years.

In the remaining systems of the body the properly trained athlete should develop few complaints and physiotherapy has no part to play in their physiological treatment. However, if training is too rapid or severe, and especially if competition is too prolonged, he may develop many symptoms referable to these systems. It is the duty of the practitioner to recognize these, to be able to exclude the organic and to treat the psychogenic. Some of the more common concern circulatory and respiratory responses, especially the heart. Careful examination and reassurance are needed, the latter frequently involving a simple explanation of the effect of emotions on the viscera. Nervous dyspepsia is common before and during competition, whilst weight loss is the most common objective sign of staleness. General nervous irritability may take the form of itching of the legs and feet at night or of frank insomnia. The latter is an anxiety symptom. In all these conditions, physiotherapeutic measures are valuable aids to the essential mental assessment and reassurance. Early assistance may be given by the sedative effect of general massage; warm baths may be used similarly. In the most severe cases, the ultimate treatment consists of general rest, primarily from competition but also for a time at least from training.

The whole question of "staleness" then comes up. Its symptoms of weakness and lassitude, anorexia and weight loss, its signs of sunken eyes and flabbiness of muscle are reminiscent of chronic adrenal exhaustion. Its treatment is essentially removal of the cause, which is excessive competition; it necessitates a complete rest, with change of interest and occupation. This treatment is physiotherapy in its broadest sense.

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TWINS AND TRIPLETS, QUADRUPLTS AND QUINTUPLETS SOME FACTS AND FANTASIES

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The human female is characteristically monogamous. Bearing sons for one young at a time. Since man and his domesticated mammals differ in this respect, to this variance a value has almost been given. Man commonly has regarded himself as being superior to the animals he has tamed, and therefore his attributes, monogamy among them, have by him been held to be better, higher, more god-like than theirs. For a human female to produce a veritable litter was therefore to behave like a beast and to merit blame.

Since it was customary for the human birth process to yield a single child it followed that no man could possibly be the father of more than one at a time, and that any woman who gave birth to twins must have been unfaithful and was to be punished, together with the infants which her mate had not used. For one of the twins was the sequel of the visitation of an evil supernatural being and the mother was therefore accursed and had to be sacrificed along with one of the infants. The witch-doctor could readily distinguish between the legitimate and the bewitched.

In other times and places, but far less commonly, polygamy has been regarded among primitive peoples as a manifestation of the blessing of the tribal god of fertility. Then the parental pair was to be honoured and the male could foster his fecundity with pride, and to the twins were ascribed supernatural powers and the possession of peculiar immunities.

These are representative samples of the notions out of which our present-day attitude towards human polytocry have sprung. We are as interested as ever in the phenomenon itself but our reactions to the unusual have changed with the passing of time and with the modification of cosmologies. We fashioned the fears of our forebears into the salacious humour of the taproom. Nowadays, in civilized communities, multiple births arouse interest among the laity because they are exceptional, and because it is commonly reputed that between twins there is a peculiar mutual intimacy and interdependence. To them is ascribed the power of mental telepathy, since between them there is supposed to be this psychic bond, and their individual personalities are to a large extent merged into the unity that is the pair. Scientific investigation has supplied evidence which suggests that for these views there is some warranty.

The unique feat of successfully rearing every one of the Dionne quintuplets and the world-wide publicity that was released concerning them have lately given to multiple births generally and function, which value. What almost amounts to an unofficial interment of the hereditary (genetic) to be taking place and the U.S.A. seems to be leaving which were received by break the record now held by Canada. matozoon which went

local stimulation by heat in all forms is desirable. One of the most resistant is the Achilles tendon, for which no treatment is so effective as prolonged rest from competition, relaxation by raising the heel in the shoe by sponge rubber, counter-irritation either physical or chemical, and deep heat by diathermy.

In the muscular system, one of the most difficult problems facing the practitioner is the older athlete who comes complaining of undue stiffness and aching; he wants to be as active and symptomless as in his younger days. Physiotherapeutic measures can be of great help to him, especially in the correct proportioning of rest and exercise in its various forms in his training. Swimming in warm water is a most soothing and relaxing exercise. Heat and massage too are valuable in aiding the circulation which age has decreased: but more valuable is the advice that although his desire for activity has not diminished, his physiological ability suffers with increasing years.

In the remaining systems of the body the properly trained athlete should develop few complaints and physiotherapy has no part to play in their physiological treatment. However, if training is too rapid or severe, and especially if competition is too prolonged, he may develop many symptoms referable to these systems. It is the duty of the practitioner to recognize these, to be able to exclude the organic and to treat the psychogenic. Some of the more common concern circulatory and respiratory responses, especially the heart. Careful examination and reassurance are needed, the latter frequently involving a simple explanation of the effect of emotions on the viscera. Nervous dyspepsia is common before and during competition, whilst weight loss is the most common objective sign of staleness. General nervous irritability may take the form of itching of the legs and feet at night or of frank insomnia. The latter is an anxiety symptom. In all these conditions, physiotherapeutic measures are valuable aids to the essential mental assessment and reassurance. Early assistance may be given by the sedative effect of general massage; warm baths may be used similarly. In the most severe cases, the ultimate treatment consists of general rest, primarily from competition but also for a time at least from training.

The whole question of "staleness" then comes up. Its symptoms of weakness and lassitude, anorexia and weight loss, its signs of sunken eyes and flabbiness of muscle are reminiscent of chronic adrenal exhaustion. Its treatment is essentially removal of the cause, which is excessive competition; it necessitates a complete rest, with change of interest and occupation. This treatment is physiotherapy in its broadest sense.

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every detail (Fig. 1A¹). Should it occur significantly later the cleavage can be incomplete, with the result that conjoint (Siamese) twins make their desperate appearance (Fig. 1A²). It sometimes happens that when the uterus is shared by twin embryos of this kind, between them during the earlier stages of their development there arises a competition for blood supply. One happens to gain and retain the ascendancy and flourishes, whilst its fellow, being starved, fails to achieve normal development and at parturition presents itself as the incomplete parts of a fœtus attached to the body of the other. Such a partnership constitutes a double monster (Fig. 1A³). It should be noted that conjoint twins and double monsters are always monovular in origin.

It is established that sex is determined at the moment of fertilization.

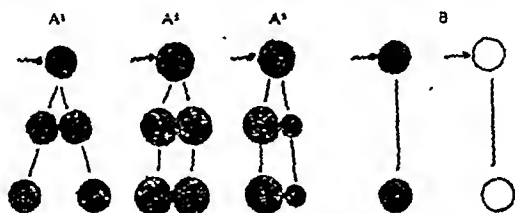


FIG. 1A¹.—Normal monovular twins. The products of a single fertilized ovum. Genetically the same individual in duplicate.

FIG. 1A².—The same, but as the result of incomplete separation, conjoint or Siamese twins.

FIG. 1A³.—The same, but as the result of a grossly unequal blood supply to the two embryos one fails to flourish and ends as parts of a fœtus attached to the body of its fellow twin. A double monster. Sex.—2 males or else 2 females.

FIG. 1B.---Binovular twins. Two genetically distinct and ontogenetically separate individuals from the very beginning. Sex.—2 males or 2 females or 1 male and 1 female.

FIG 1.—The mechanism of polytocoty. *Twins*.—Two kinds, one mon-, the other bin-ovular.

There are two kinds of spermatozoa, male- and female-determining, respectively. The sex of the future individual is determined by the kind of spermatozoon that enters the ovum. Since among the children born at different times to the same parental pairs there are both boys and girls, it follows that there can be no reason why binovular twins should always be of the same sex. They are not. They can be both boys, both girls, or a boy and a girl. Since a child originating in one and the same fertilized ovum can be either a boy or else a girl, and since monovular twins arise in one and the same fertilized ovum, they should be, and are, of the same sex, being either two boys or else two girls.

Many of the characters, details of structure and function, which are displayed by an individual, are the expressions of the hereditary (genetic) constitution of the individual, the ingredients of which were received by him from his parents by way of the ovum and spermatozoon which went

Furthermore, during the last twenty years polytocy has come to be regarded as a priceless gift poured by Nature into the lap of science, by means of which the relative rôles of heredity and environment in the moulding of the characterization of the individual and the group can be assessed: a matter of supreme importance to all who are concerned in programmes of human and social betterment.

GENERAL CONSIDERATIONS

In normally polytocous animals the number of offspring to be born at any one time is determined by the number of ova made available by the female. Two or more are extruded from the same follicle, from different follicles in the same ovary or from the two ovaries. It has been established that the processes of ovulation are normally under the control of hormones elaborated by the pituitary and that it is possible experimentally to increase the number of ova extruded at any one time, at least in animals other than man, by appropriate endocrine and nutritional treatment.

Binovular twins.—The number of spermatozoa available for fertilization is legion. Disregarding polyspermy, which is known to occur very exceptionally, following upon the entrance of one spermatozoon into an ovum, specific changes occur in the texture of the surface of the fertilized ovum, with the result that the passage thereinto on the part of all others is barred. It therefore follows that if two or more ova are fertilized synchronously each must have been entered by a different spermatozoon.

In such circumstances polytocy takes the form of the conception of two or more quite distinct individuals at one and the same time. Polytocy of this kind occurs exceptionally in the normally monotocous species. Two siblings (brothers and sisters) so conceived are known as fraternal or binovular twins. They must of necessity have had the same mother but they need not have had the same father. The two spermatozoa concerned can have been provided by different males if these indulged in intercourse with the mother in rapid succession during the period around the time of ovulation.

Monovular twins.—But there are twins of another kind which have their origin in a single ovum fertilized by a single spermatozoon—the so-called identical or monovular twins. Normally, the fertilized ovum divides to form two daughter cells and these and their descendants in their turn continue to divide rapidly and continuously until in the end the body of the new individual is fashioned. But it would seem that if for any reason, innate or environmental in origin, there should be a significant slowing down of ontogeny during the earliest stages, the embryo, as a single individual, undergoes a dichotomy to form two separate embryos. In this way two individuals are produced. This twinning division occurs quite early in the development of the embryo the two resultant individuals are complete in

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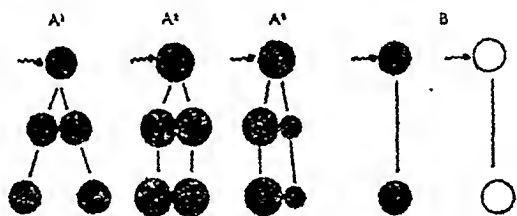


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Many of the characters, details of structure and function, which are displayed by an individual, are the expressions of the hereditary (genetic) constitution of the individual, the ingredients of which were received by him from his parents by way of the ovum and spermatozoon which went

to his making. The fact that offspring born at different times to the same parents can differ among themselves quite markedly in respect of such genetically determined characters as blood group, eye colour, hair colour and form, skin colour, complexion, finger and palm prints, tooth arrangement, shows that in respect of the predeterminers of these characters (the genes) parents are usually very heterozygous. Siblings differ among themselves therefore partly because they received different genetical endowments from their parents. It is because the genetic constitution of different ova

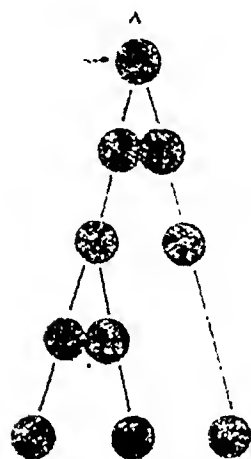


FIG. 2A.—Monovular triplets. Just as the original embryo divided to form two separate embryos, so also does one of these divide again. The cause that was operating to produce twins continues to operate to produce triplets. Genetically the same individual in triplicate. Sex.—3 males or 3 females.



FIG. 2B.—Binovular triplets. A pair of monovular Sex.—3 males or 3 females or 2 males and a female or 2 females and a male.

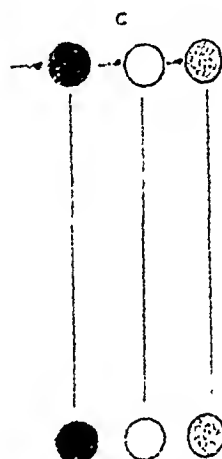


FIG. 2C.—Triovular triplets. Three genetically distinct and ontogenetically separate individuals from the beginning. Sex.—3 males or 3 females or 2 males and a female or 2 females and a male.

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But monovular twins must of necessity share a common genetic endowment. It therefore follows that in respect of those characters which are wholly or mainly genetically determined monovular twins should be remarkably alike. They are.

All that has been said of monovular twins applies equally to all monovular multiples; all that has been referred to binovular twins applies also to all polyovular multiples. It is of importance to note that monovular and polyovular multiples are not to be distinguished by differences in the architecture of their embryonic membranes. Monovulars are usually mono-

chorionic, but if the twinning division into separate embryos has been more than usually late they can be polychorionic. Polyovulars are usually polychorionic, but there can be such a fusion of the originally separate membranes that in the end there would seem to be only a single set. It is this event which is responsible for the periodic and irritating announcement

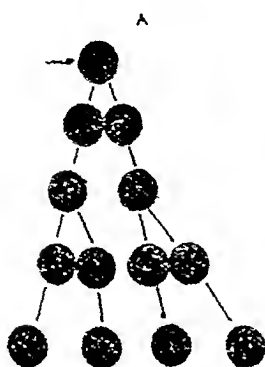


FIG. 3A.—Monovular quadruplets. The difference between monovular triplets and quadruplets is simply that in the latter case both of the two embryos produced by the division of the original embryo again divide to form two further embryos. Genetically the same individual in quadruplicate.
Sex.—4 males or 4 females.

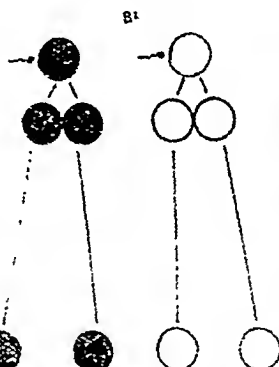


FIG. 3B¹.—Binovular quadruplets. Two sets of monovular twins. Two genetically distinct individuals each in duplicate.

Sex.—4 males or 4 females or 2 males and 2 females.

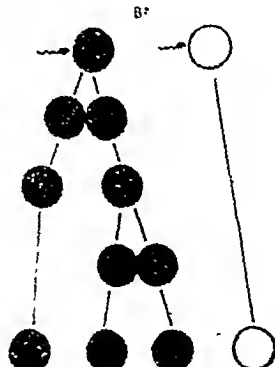


FIG. 3B².—Binovular quadruplets. One set of monovular triplets together with a singleton. Two genetically distinct individuals, one in triplicate.

Sex.—4 males or 4 females or 3 males and a female or 3 females and a male.

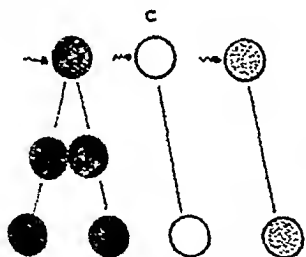


FIG. 3C.—Triovular quadruplets. A pair of monovular twins together with a pair of binovular twins. Three genetically distinct individuals, one in duplicate.

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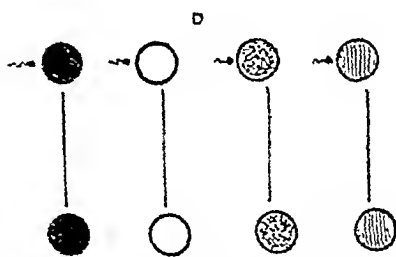


FIG. 3D.—Quadriovular quadruplets. Four genetically distinct and ontogenetically separate individuals from the beginning.

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FIG. 3.—The mechanism of polytoc. *Quadruplets*.—Five kinds, one mon-, two bin-, one tri- and one quadri-ovular.

that the birth of monovular twins, one a male the other a female, has destroyed current theories concerning the manner in which, and the time at which, sex is determined.

Monovulars are to be distinguished from polyovulars by differences in the degree of concordance between the individuals concerned in respect of

to his making. The fact that offspring born at different times to the same parents can differ among themselves quite markedly in respect of such genetically determined characters as blood group, eye colour, hair colour and form, skin colour, complexion, finger and palm prints, tooth arrangement, shows that in respect of the predeterminers of these characters (the genes) parents are usually very heterozygous. Siblings differ among themselves therefore partly because they received different genetical endowments from their parents. It is because the genetic constitution of different ova

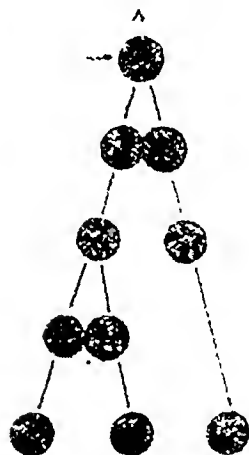


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FIG. 2B.—Binovular triplets. A pair of monovular embryos, one of which divides again. Sex.—3 males or 3 females or 2 males and a female or 2 females and a male.



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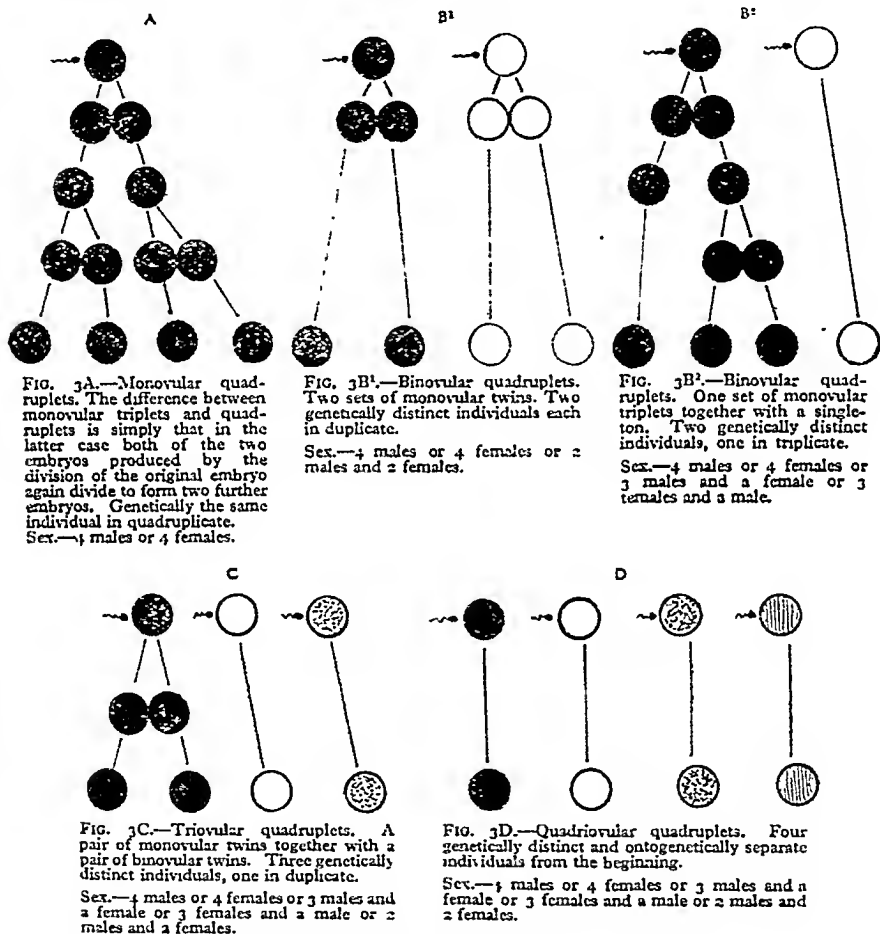


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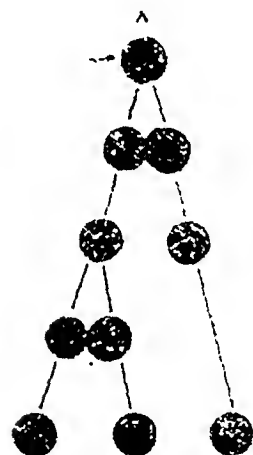


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FIG. 2B.—Binovular triplets. A pair of monovular twins together with a singleton. Two genetically distinct individuals, one in duplicate. Sex.—3 males or 3 females or 2 males and a female or 2 females and a male.

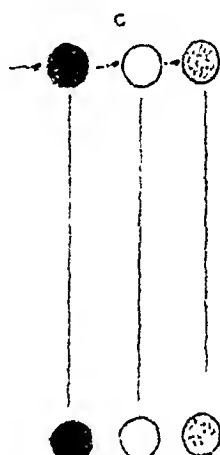


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FIG. 4.—The mechanism of polytocy.—(*Quintuplets. cont.*)

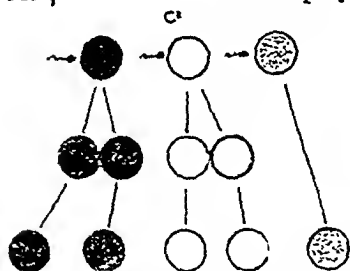


FIG. 4C.—Triovular quintuplets. Two sets of monozygotic twins together with a singleton. Three genetically distinct individuals, two of them each in duplicate.

Sex.—5 males or 5 females or 4 males and a female or 4 females and a male or 3 males and 2 females or 3 females and 2 males.

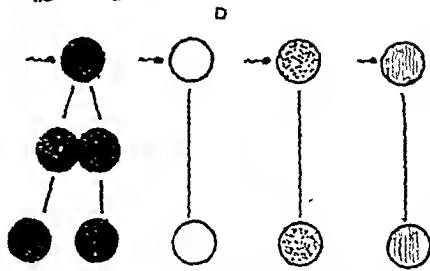


FIG. 4D.—Quadriovular quintuplets. A pair of monozygotic twins together with a set of triovular triplets. Four genetically distinct individuals, one in duplicate.

Sex.—5 males or 5 females or 4 males and a female or 4 females and a male or 3 males and 2 females or 3 females and 2 males.

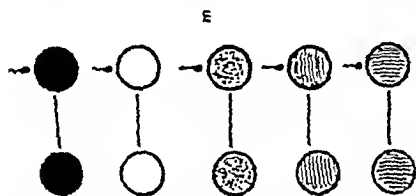


FIG. 4E.—Quintovular quintuplets. Five genetically distinct and ontogenetically separate individuals from the beginning.

Sex.—5 males or 5 females or 4 males and a female or 4 females and a male or 3 males and 2 females or 3 females and 2 males.

sex, blood group, blood pressure, pulse and respiratory rates, eye colour, eyelash and eyebrow colour and shape, visual acuity, hair colour and form, hair whorls, skin colour, complexion, lip and ear shape, tooth size and arrangement, shape of fingers and fingernails, manner of clasping objects, electro-encephalographic pattern, inmirror-imaging, and pathological stigmata, when

present. It is established that correlation in respect of these is far greater between monozygotes than between polyzygotes.

The division of an embryo to form the beginnings of two individuals must be an event that is restricted to the earliest stages of ontogeny. Moreover, there must be a limit to the number of embryos that a uterus can accommodate. Thus, although it may happen, and probably does, that more than five embryos may be formed by the repeated division of pre-existing embryos, it has to be assumed that the birth of more than five living infants at one and the same time will be among the rarest of phenomena. There are on record quite a few instances of the production of sextuplets (of which there could be ten different kinds), but surrounding the majority of them there is considerable doubt. It will be remembered that the medical attendant of the Dionne quintuplets was firmly of the opinion that originally there had been six embryos and that one of them had been aborted around the third month of pregnancy. Scattered in the literature there are to be found references to as many as nine, eleven, even thirty-five infants being born to the same woman at one and the same time. It has to be suspected that what was anecdotal had been too eagerly accepted by the hyper-

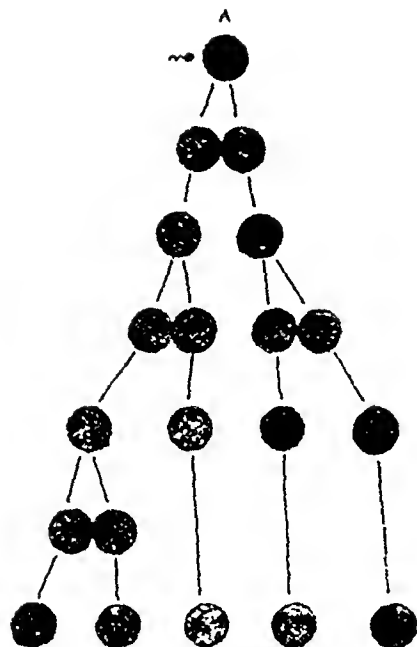


FIG. 4A.—Monovular quintuplets. It is seen that there can be divisions of the embryos into two in successive embryonic generations and that this process can affect one or more embryos of the same embryo generation. The difference between monovular twins, triplets, quadruplets and quintuplets would seem to be determined by the persistence during the earliest stages of ontogeny of the cause of such division. Genetically the same individual in quintuplicate.

Sex.—5 males or 5 females.

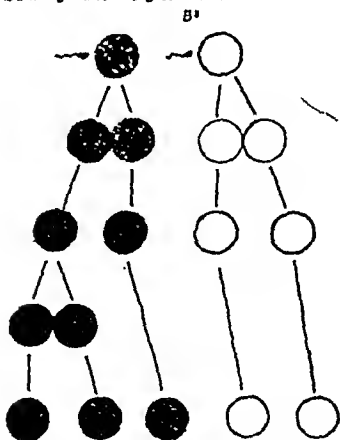


FIG. 4B¹.—Binovular quintuplets. A set of monovular triplets together with a set of monovular twins. Two genetically distinct individuals, one in triplicate the other in duplicate.

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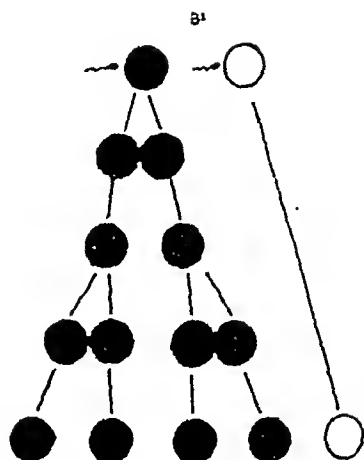


FIG. 4B².—Binovular quintuplets. A set of monovular quadruplets together with a singleton. Two genetically distinct individuals, one in quadruplicate.

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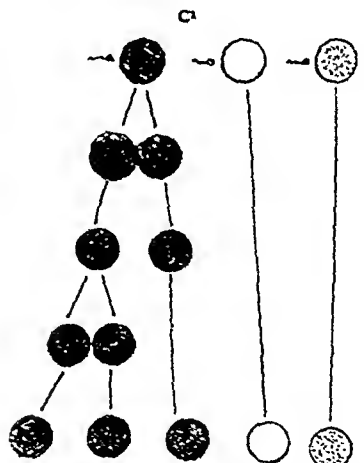


FIG. 4C¹.—Triovular quintuplets. A set of monovular triplets together with a pair of binovular twins. Three genetically distinct individuals, one in triplicate.

Sex.—5 males or 5 females or 4 males and a female or 4 females and a male or 3 males and 2 females or 3 females and 2 males.

FIG. 4—The mechanism of polytoccy. *Quintuplets*.—Seven kinds, one mon-, two bin-, two tri-, one quadri- and one quint-ovular.

then that of triplets is P^3 and that of quadruplets P^4 . This remarkable observation, although not yet explained, has not been seriously shaken by later investigation (see Zelcny, 1921; Peller, 1946).

INDUCED POLYTOCY AS A METHOD OF MAINTAINING POPULATION SIZE

That which happens naturally can, when the mechanism is known, usually be induced artificially. Induced polyovular polytoccy by means of nutritional and endocrine treatment has claimed its place in livestock production practices. It is reasonable to assume that these techniques would be found to be applicable to the case of the human female. The exact nature of the cause of monovular polytoccy is not yet understood. It would seem to have a genetic basis, for a monovular twin occasionally produces monovular twins and there is a slight but significant excess of twins among the offspring of the singleton siblings of twins. If there is this genetical basis it becomes possible to understand how it can be that the male can introduce into a mating the tendency to produce twins. The gene(s) could pass into the fertilized ovum by way of the spermatozoon and exert an influence upon the rate of the ontogenetic processes. It must be acknowledged, however, that the evidence concerning the rôle of the male in twinning is by no means unequivocal. If the cause of monovular polytoccy is genetical in nature then it would not be surprising to find that the character is expressed with the same order of frequency by all the national groups of Europe. This is the case. In all, the proportion of monovulars among all twins is around 25 per cent. So is it also in the U.S.A. and Japan. Polyovular twinning, on the other hand, differs markedly in its frequency among the different national groups.

Whilst it is not reasonable to suggest that deliberate attempts should be made to increase the frequency of these genes in a population, it is eminently possible that biochemical instruments could be forged by means of which the action of these genes upon the processes of development could be exactly imitated and the frequency of monovular polytoccy increased. In the light of what is already known, however, it would seem that the easier task would be to increase the frequency of polyovular polytoccy, since this appears to be far more readily influenced by the general physiological state of the mother. Whilst monovular polytoccy occurs with the same frequency at all ages of the mother, polyovular polytoccy varies considerably. The probability of producing binovular twins, for example, increases up to the age of thirty-five to forty, and thereafter decreases. But even so, the forty-five to fifties produce more twins than do the fifteen to twenties.

There is a widespread opinion among the laity that it would be an advantage if the production and raising of a family could be compressed into the minimum period of time. But before the means of giving the

credulous. There is, of course, always the hydatidiform mole to be transformed into a congregation of homunculi by the imaginative.

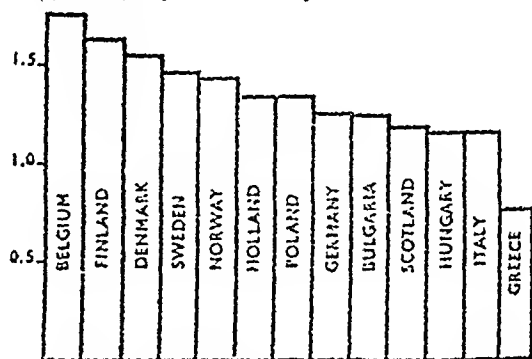
THE FREQUENCY OF POLYTOCY

Such figures as exist show that in so far as Europe is concerned polytoey is most frequent among the populations of the North-West and least frequent among those of the South-East. Nothing would therefore be easier than to conclude that this difference is to be explained by reference to ethnic or climatic differences. But the position of Scotland in the list makes such reasoning distinctly hazardous (fig. 5).

Scotland does not differ significantly from the countries of North-West Europe in respect of ethnic composition or climate. It does, however, in respect of its infant mortality and still-birth rates, which are much more like those of the countries of South-East Europe than those of the North-West. It

PERCENTAGE OF TWINS

FIG. 5



seems highly probable that the recorded differences in respect of the frequency of multiple births are really reflections of differences in the frequencies of abortion and still-birth.

If the two forms of spermatozoa, X-chromosome-bearing and Y-chromosome-bearing respectively, are produced in equal numbers, if both are equally efficient in fertilization and if both kinds of resultant individuals, males (XY) and females (XX) are equally viable, then the sex-ratio among the newly born should be equality. It is, in fact, about 105 males : 100 females. It is to be expected that pooled monovular multiples will present the same sex-ratio, as also will polyovulars. If monovulars and polyovulars are produced in equal numbers there should be among them more or less equal numbers of same-sexed and different-sexed sets. But there are not. There is a significant excess of same-sexed sets, which can only mean that monovulars and polyovulars are not produced in equal numbers. Investigation has shown that about 25 per cent. of all twins, about 48 per cent. of all quadruplets, and about 40 per cent. of all quintuplets are monovulars.

Hellin, in 1895, studying the vital statistics of South Germany, observed that twins occurred with a frequency of 1 in every 88 births, triplets with a frequency of 1 in 88² births and quadruplets with a frequency of 1 in 88³ births. Generalized, Hellin's law states that if the frequency of twins is P,

monovulars reared together, between monovulars reared apart, between polyovulars reared together, between polyovulars reared apart, between ordinary brothers and sisters reared together and between representative samples of all of these groups, should furnish conclusive evidence as to which characters are genetically determined, which are the end-result of the interplay of heredity and environment, and which are merely acquisitions (modifications).

Monovulars are never phenotypically identical, never completely alike in respect of their characterizations. Since they are of necessity genetically identical, such dissimilarities as they exhibit must be reflections of differences in experience. Although developing in the same uterus they do not endure exactly the same experience; their blood supplies are never entirely similar, so that they can come to show marked differences in respect of growth rate, for example. At parturition it is eminently possible for them to encounter different circumstances and to suffer different kinds and degrees of hurt. Post-natally the experiences of no two individuals can ever be exactly the same. Yet monovular twins reared together show a greater degree of concordance in respect of general characterization than do any other kind of pair of individuals, and the earlier in the ontogeny of the original embryo the division into two embryos occurred the greater is the degree of concordance between the resulting individuals.

It should be remembered that in the development of the normal single embryo there comes a point when the two lateral halves of the embryo assume different growth rates to yield that lateral asymmetry which is the common property of all individuals. If the twinning division occurs after this differential growth rate has become established, then one twin grows more rapidly than does its fellow, so that the two can differ in respect of size and weight, general and local, at birth.

The later in ontogeny the twinning division occurs the more likely is it that the twins will show mirror-imaging. Since Siamese twins are the result of such late separation they invariably exhibit this phenomenon to a marked degree; the heart of the right twin is slanted to the right, that of the left to the left; the right one has a right aorta, the left a left one; the hair whorls of the one run clockwise, those of the other counter-clockwise; one is right-handed, the other left-handed; the finger and palm prints of the right hand of the one are the mirror image of those of the left hand of the other. About 20 per cent. of monovular twins show this phenomenon in some degree, and the degree is a rough measure of the time during the development of the original embryo when the twinning division took place; the earlier the twinning division the less the mirror-imaging. Twins showing this mirror-imaging are of course less alike than are monovulars who do not show it.

Twin studies have shown in the clearest possible fashion that in making assessments of the parts played by heredity and environment respectively

people what they ask are perfected it is necessary to consider the extraordinary hazards that twins, triplets and the rest must now face.

In general, if a species is to flourish, the individuals of one generation must produce a succeeding generation not numerically inferior to itself. If, in the case of a given species, there is much wastage through mortality, especially among the young, population numbers can be maintained and increased only if very large numbers of offspring are produced so that in spite of the high mortality sufficient survivors remain. If such mortality can be avoided this reproductive extravagance becomes unnecessary. It can be avoided by giving to the fewest possible offspring compatible with species maintenance the greatest possible care. Our species is so equipped that to our young such care can be given both pre- and post-natally during the long period while they are still immature. The primate uterus and maternal equipment generally have become fashioned through time and selection for the accommodation of a single embryo and fœtus. This being so, it is to be expected that mortality among multiples will greatly exceed that among singles.

It is generally agreed that probably not more than 20 to 50 per cent. of all the twins that are conceived are alive at the end of the period of pregnancy, that still-birth is some three to four times as common among monovular twins as among singletons, and that birth injuries are far more frequent among multiples, for the reason that their mutual interference during parturition leads to faulty presentation. As the result of such birth injury the incidence of mental deficiency is higher among multiples than among singles. Premature birth is common among twins and universal among triplets, quadruplets and quintuplets. This was a matter of even greater importance in the days before incubators had been perfected. There are figures which show that not less than twice as many twins as singletons die in the neo-natal period. Therefore before polytoccy can be adopted as a policy it is necessary greatly to augment the powers of preventing abortion due to uterine crowding and still-birth due to dystocia, of repairing prematurity and of avoiding neo-natal mortality. For the present there is far too much mortality attached to multiplicity to make the latter worth while.

NATURE *versus* NURTURE

The relative rôles of Nature and Nurture in the fashioning of the characterization of the individual can best be assessed by careful examination of the similarities and dissimilarities exhibited by monovular and polyovular multiples reared together and reared apart. If heredity is all-important, then monovulars reared apart should still retain a very high degree of similarity. If environmental agencies are all-important, then polyovular multiples reared together should come to exhibit marked similarity. The degree of concordance and of dissimilarity between

PAIN AND ITS PROBLEMS

III.—CARDIAC PAIN

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WHEN Heberden (1768) first described a disorder of the breast which he named angina pectoris, he had no idea that it had any connexion with the heart. Jenner and others were soon on the trail of the coronary arteries, but unfortunately the issue became side-tracked in a maze of theories, and clinical progress was halted. The clinical syndrome which Heberden so accurately described soon became confused with neurotic symptoms and this confusion has persisted up to quite recent times. So long as the cause of angina pectoris remained in dispute, its clinical diagnosis was always open to question, although sudden death was accepted as a strong argument in its favour. For this reason the common milder forms of angina pectoris usually escaped recognition, and the disease, as it was then regarded, acquired a far too gloomy prognosis.

In 1912, Herrick paved the way to a rational solution of the problem of cardiac pain by identifying the clinical manifestations of coronary thrombosis and thus providing the proof that anginal pain could be caused by sudden interference with the blood supply to the heart muscle.

ETIOLOGY

Although much remains to be learned about the mechanism of production of cardiac pain, it is now generally accepted that myocardial ischæmia is the underlying cause. The pain-exciting stimulus is almost certainly a chemical one, arising from an accumulation of abnormal metabolic products of muscular activity in the absence of an adequate supply of oxygen. It is now possible to correlate anginal pain with its various pathological causes in terms of myocardial ischæmia and anoxæmia. The coronary flow may be reduced by organic obstruction or vasoconstriction of the coronary vessels, or by a lowered aortic diastolic pressure, and anoxæmia may result from qualitative as well as from quantitative changes in the blood supply. Any factor which increases the work of the heart, for example, paroxysmal tachycardia, will predispose to a condition of relative ischæmia, especially if the coronary flow is restricted. Lastly, the metabolic changes due to thyrotoxicosis or myxœdema in some way predispose to anginal pain, mainly in elderly subjects with some degree of coronary sclerosis.

The common pathological causes of cardiac pain are as follows:—

(A) *Anatomical*

- (1) Coronary atherosclerosis with or without thrombosis
- (2) Coronary embolism
- (3) Obstruction of the coronary orifices by syphilitic aortitis
- (4) Aortic incompetence (lowered diastolic pressure)

in the moulding of the characterization of the individual, it is necessary to consider each character separately. There are a few characters, e.g., the blood group, sex, eye colour, that are determined wholly by hereditary forces, but for the great majority both heredity and environment are essential interacting factors. In the case of some of them hereditary factors overshadow environmental factors, in others the latter are the more important. It has been estimated, for example, that heredity is about seventeen times as influential as is environment in determining finger-print patterns, about four times as influential in determining standing height, weight and head form, about twice as influential in determining the intelligence quotient and educational age, and just about as effective as is nurture in determining the rate of tapping. Such characters as mutilations, of course, owe nothing to heredity.

Twins have been used with much profit as experimental material by the geneticist, the psychologist, the educationist, the criminologist, and by the psychiatrist, particularly in the U.S.A., and for a time in the U.S.S.R., where intensive research was conducted on a truly grand scale. But even yet it is not sufficiently recognized that in the field of medicine there can be no more useful instrument of inquiry in the search for causation than twins. It has been amply demonstrated that in the case of the majority of diseases the cause is multifactor, taking the form of a proneness on the part of the individual and a provocation on the part of some ingredient of the individual's external world. The relative importance of the two in etiology is best revealed in comparative studies of monovular and polyovular multiples contrasted with the rest of the population at risk. Scientific therapy and prevention must wait upon accuracy in etiology. Knowledge and power in medicine would be rapidly and greatly advanced if very special attention were given to the multiples in our midst, and if by us their unique value was made known.

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Paroxysmal anginal pain apart from effort (angina of decubitus, spasmodic angina).—Spontaneous anginal attacks are as a rule more prolonged and more severe than those due to effort. Most patients subject to anginal pain have occasional attacks at rest, induced perhaps by emotion, a full stomach or exposure to cold; a few have such attacks repeatedly or periodically over months or years, either in the daytime or at night. In exceptional cases these spontaneous attacks are almost exclusively nocturnal, recurring nightly, as happens in syphilitic cases and in those with aortic incompetence. The pain is usually relieved by nitrites, and morphine is not often required.

It must not be supposed that all prolonged anginal attacks occurring at rest are due to coronary thrombosis, for they may be incidents in the course of progressive coronary disease or other conditions later to be described.

Vasomotor angina.—A characteristic anginal syndrome may occur in cases of aortic incompetence, often in relatively young subjects. The attacks may be provoked by effort, but more often they occur spontaneously, after meals, or at night. Severe and relatively prolonged pain is accompanied by great acceleration of the heart, forcible throbbing of the arteries, sweating, flushing and a transient elevation of blood pressure which may surpass 200 mm. Hg systolic during the attack. Lewis noted that the pain was readily relieved by nitroglycerin or by amyl nitrite, and he attributed it to a generalized vasoconstriction involving the coronary vessels. This form of vasomotor angina is most frequently encountered in young adults with rheumatic aortic incompetence, but it also occurs in the syphilitic type and in older subjects. Apart from aortic incompetence, I have seen identical attacks in women with hypertension.

THE SYNDROME OF CORONARY OCCLUSION

Sudden occlusion: coronary thrombosis.—When a coronary branch is occluded by thrombosis the area of heart muscle which it normally supplies is rendered ischæmic, and part of it undergoes ischæmic necrosis. The clinical counterpart of these pathological events consists essentially of a severe and prolonged anginal seizure, accompanied by signs of shock, such as pallor, sweating, vomiting, fall of blood pressure, and even syncope. If the patient survives, as often happens, signs of cardiac injury follow, namely, small rapid pulse, low blood pressure, abnormal cardiac rhythms, and not infrequently signs of left heart failure, such as pulmonary œdema. The process of infarction gives rise to constitutional reactions in the form of slight fever lasting up to a week, leucocytosis, and an increased blood sedimentation rate. Focal complications consist of rupture of the heart wall, thrombosis on the endocardial aspect and pericarditis on the epicardial aspect of the infarcted area. During the first few weeks after a coronary thrombosis life is always in jeopardy, but most patients, perhaps 75 per cent., survive this acute stage, and some recover sufficiently to lead useful and active lives for periods up to five to ten years, and occasionally longer.

The process of myocardial necrosis and healing is reflected in the electro-

(B) Functional

- (1) Coronary vasoconstriction
- (2) Severe anæmia
- (3) Paroxysmal tachycardia, hypertension (increased work)
- (4) Thyrotoxicosis and myxœdema

THE CLINICAL FEATURES OF CARDIAC PAIN

The pain is usually located in the midline, behind the sternum, or extends horizontally across the chest, most frequently at the level of the middle of the sternum, but often at its upper or lower thirds. Pain which is primarily sternal may radiate to the spine, down one or both arms, and to the neck, jaw, teeth or tongue. Occasionally the flow of pain is reversed, and it starts in the arms or jaw, to settle later in the chest. Although radiation to the areas described is common in severe anginal attacks, it is frequently absent, especially in mild attacks. The pain need not be severe, and may amount to no more than a sensation of tightness or oppression which the patients insist is due to indigestion, and which is often accompanied by flatulence and belching. Indeed, whenever a patient complaining of indigestion locates it in the chest, a cardiac origin should be suspected.

In the vast majority of cases the site of cardiac pain is as described, but there are occasional exceptions in which the pain may be eccentric, lying to the right or left of the sternum, or in the spine, and very rarely under the left breast. It is important to form the habit of describing chest pain precisely in relation to the thoracic wall, and to encourage patients to do likewise. Much confusion is caused by describing both cardiac pain and the common left breast pain of neurotic origin as "præcordial". Applied to cardiac pain, the term is inaccurate, and to neurotic pain, most undesirable. It can best be avoided by thinking of cardiac pain as *sternal* and of neurotic pain as *mammary*.

Anginal pain has the quality of a steadily mounting and persistent constriction or pressure and is often described as "gripping", but never as "shooting" or "stabbing". The severity and duration of the pain and the circumstances in which it arises depend upon the underlying cause, and vary from the fleeting retrosternal oppression provoked by hurrying to the prolonged agony of coronary thrombosis. For clinical purposes anginal attacks may be classified as follows :—

Angina of effort.—The most common form of anginal pain is that provoked by effort, especially by efforts of locomotion, such as hurrying, walking uphill or against the wind. The liability to pain on exertion is greater after a meal or in cold weather. Immediate relief is usually obtained by slowing down or halting, but once pain becomes severe it may take five minutes or more to pass completely. Most patients subject to effort pain learn to pull up quickly and rarely need to use nitroglycerin. In those with severe coronary obstruction the relation of pain to effort may be less evident because they avoid exertion at all costs, but they will usually admit, if asked, that it is pain which prevents them exerting themselves.

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friction, signs of pericardial effusion, and constitutional symptoms of a severe infection will suggest that pericarditis is of infective origin rather than due to coronary thrombosis.

Aortic pain.—The "aortic theory" of angina pectoris is now a matter of historical interest, and to-day it is generally held that uncomplicated syphilitic aortitis is a clinically silent and painless condition. Syphilitic angina pectoris occurs only in the presence of aortic incompetence or of coronary involvement. The pressure effects of aortic aneurysm should always be in mind as a cause of thoracic pain, and X-ray examination will suffice to indicate the diagnosis. Pressure on the spine causes a constant boring pain, often aggravated by exertion, and sometimes by the horizontal posture.

Dissecting aneurysm of the aorta may cause excruciating pain which is indistinguishable from that of coronary thrombosis but, if the patient survives long enough, characteristic signs of occlusion of one or more branches of the aorta from involvement in the dissection may occur, and sometimes signs of aortic incompetence. The diagnosis can at times be established by X-ray examination. The electrocardiogram is usually unaffected—another point of distinction from coronary thrombosis.

Liver pain.—When congestive heart failure is provoked suddenly, for example, by the onset of auricular fibrillation or flutter, acute swelling of the liver sometimes causes severe epigastric pain. At this painful stage, the liver is soft and extremely tender on palpation, but the edge may not be felt. I have seen this pain lead to surgical exploration of the abdomen. In cases of incipient heart failure, the liver may swell on exertion, causing effort pain which can be mistaken for angina pectoris. In these cases, the presence of auricular fibrillation, signs of valvular disease, and evidence of congestive failure will indicate the diagnosis.

Pulmonary infarction.—Pulmonary infarction is a common complication of heart failure, but it may also occur apart from failure and, of course, apart from heart disease. Sooner or later it gives rise to pleural or pulmonary signs and often to hæmoptysis, but in the early stage of pulmonary embolism shock and dyspnoea may be predominant, and coronary thrombosis may be simulated. Changes in the electrocardiogram follow large pulmonary emboli and are caused by sudden strain on the right heart. The pain is characteristically pleural, located in the lower lateral part of the chest, and is aggravated by breathing.

DIFFERENTIAL DIAGNOSIS OF CARDIAC PAIN

Left mammary pain.—This common symptom of neurotic ill health is so often attributed to the heart, and those subject to it are so often referred to cardiac clinics, that it requires special mention in relation to the diagnosis of cardiac pain. It consists of a dull persistent ache or sensation of soreness and discomfort, usually located below the left breast, when it may extend to the left scapula, but sometimes located above the left breast, when it may extend down the left arm or to the left side of the neck. This persistent

cardiogram by a series of characteristic changes which are often diagnostic and which localize the infarct to the anterior or posterior surface of the heart. The time relation of these electrocardiographic changes to the initial attack of pain is somewhat variable, and a single record may fail to show them, but if chest leads are included, serial electrocardiograms almost invariably provide evidence of cardiac infarction.

There is nothing characteristic about the anginal pain of coronary thrombosis except its severity and duration; it may last for hours or days unless relieved by morphine, and nitrites are usually without effect. It is the accompanying shock and symptoms of acute cardiac injury which distinguish coronary thrombosis from other forms of spontaneous anginal pain, and it is these same accompaniments which lead to difficulties in diagnosis, e.g. when shock and vomiting suggest an acute abdominal cause.

Progressive coronary occlusion.—Gradual obstruction of the coronary circulation and progressive ischaemic fibrosis of the myocardium may be caused by coronary atherosclerosis, or by syphilitic ~~aortitis~~ ^{aortic stenosis} which involves the coronary orifices. The clinical consequences may be ~~angina~~ ^{angina} of effort of increasing frequency and severity, or recurrent ~~spontaneous~~ ^{spontaneous} anginal attacks unaccompanied by the signs of myocardial infarction. These attacks subside and recur periodically, and may eventually culminate in a status anginosus with signs of cardiac infarction. At any time the clinical picture may change to that of left heart failure with paroxysmal dyspnoea, and sudden death during or apart from an attack of pain is common.

The syndrome of syphilitic occlusion of the coronary ostia is very similar but presents certain distinctive features. It tends to occur at an earlier age than coronary atheroma, and is almost invariably associated with syphilitic aortic incompetence. In a typical case, a man aged about forty develops angina of effort, soon followed by spontaneous and nocturnal attacks of increasing severity and accompanied by paroxysmal dyspnoea. Unless sudden death intervenes, the course of events culminates in a status anginosus with falling blood pressure and pulmonary oedema, and this may occur within a few weeks or months of the onset of symptoms.

OTHER FORMS OF PAIN ASSOCIATED WITH HEART DISEASE

Pericarditis is not usually painful, although pericardial effusion often causes a sense of oppression or weight in the chest and may be associated with orthopnoea and dysphagia. Occasionally, pericarditis of infective origin is accompanied by pain in the chest severe enough to simulate coronary thrombosis, and this is probably due to coincident pleural or mediastinal inflammation. The pain may be located behind the sternum, in the epigastrium, on one or both sides of the chest, or in the scapular region. It is usually aggravated by breathing, swallowing, or by rotation of the chest, and may be eased by leaning forward in the sitting posture. Pericarditis may cause changes in the electrocardiogram not unlike, but distinguishable from, those due to coronary thrombosis. Widespread pericardial or pleural

appearance of subcutaneous emphysema above the clavicles, and on hearing a characteristic "crunching" sound on auscultation over the heart. Sometimes an X-ray of the chest will demonstrate air in the mediastinum or pleura.

Diaphragmatic hernia, especially the para-œsophageal type, is another condition causing severe retrosternal pain very similar to that of coronary disease, although in my experience it does not spread to the arms. The pain may be accompanied by persistent retching and vomiting and sometimes by dyspnoea; it is apt to be aggravated by the horizontal posture and to occur at night. Diagnosis depends upon careful radiological examination of the chest, including the œsophagus and stomach.

Abdominal conditions.—The difficulty of distinguishing between coronary thrombosis and acute abdominal conditions such as perforated peptic ulcer, or cholecystitis, though often emphasized in the past, has diminished now that coronary thrombosis has become familiar to all, including surgeons. Provided that the possibility of coronary thrombosis is in mind in all cases of acute epigastric pain associated with vomiting, it will rarely be overlooked. A history of previous sternal pain on effort, radiation of pain to the arms, a pronounced fall of blood pressure, tachycardia, dyspnoea and œdema of the lung bases are points which may indicate the heart. In any case of doubt an electrocardiogram is likely to prove decisive, and now that portable instruments are generally available, this investigation should not be omitted.

TREATMENT OF CARDIAC PAIN

Treatment depends upon the underlying cause of the pain, and detailed discussion is beyond the scope of this article, but a few points will be mentioned. Three principle measures are applicable to cardiac pain, namely, rest, sedation and vasodilators.

A period of complete *rest* in bed is often of great value in cases of angina of effort, and is imperative in all forms of prolonged anginal pain. In the case of coronary thrombosis the duration of bed rest should be at least six weeks, and often longer is required, but for severe anginal attacks due to progressive coronary occlusion a shorter period may suffice. In ambulant patients subject to anginal pain, advice as to the avoidance of effort, and especially of effort after meals, is important.

Of *vasodilators*, nitroglycerin tablets, each 1/100 grain (6.5 mgm.) are the most effective, and may be used freely, not only to relieve but also to prevent pain, and a tablet may be chewed before setting out for a walk.

Sedatives.—In any severe attack of anginal pain not quickly relieved by nitroglycerin, opium in some form is indicated, and an injection of morphine is most effective. Nocturnal anginal pain can often be prevented by a nightly sedative, especially by an opiate, such as tincture of opium or nepenthe, and this should always be provided for use in an attack in the event of nitrites failing to afford relief. Regular sedation by barbiturates, such as luminal or amytal, is often of great value in any case of paroxysmal anginal pain.

ache is often interrupted by paroxysms of sharp shooting or stabbing pain, sometimes severe enough to suggest coronary thrombosis. Often it is labelled "pleurodynia" or attributed to pleurisy or fibrositis.

Left mammary pain is related to fatigue rather than to exertion, but it may be aggravated by effort. The mechanism by which this pain is produced has not yet been adequately explained, but it is usually regarded as the somatic component of an underlying neurotic state. The diagnosis of neurotic ill health does not rest on a single symptom, and left mammary pain is usually found to be accompanied by other and ample evidence of neurosis or anxiety, if such evidence is properly sought. Although this pain almost always has a neurotic basis, physical ill health may undoubtedly contribute to its causation, and excessive smoking, obesity, anaemia, acute infections, hypertension, and even heart disease may be predisposing conditions. The main points of distinction between neurotic and cardiac pain are given in table 1, and it should be noted that whereas both may involve the left arm, extension to the right arm or to both arms is distinctive of cardiac pain.

TABLE 1
DIFFERENTIAL DIAGNOSIS

ANGINA PECTORIS	LEFT MAMMARY PAIN
(1) Usually in men aged over fifty	(1) Commoner in women and young men
(2) Pain sternal or across the chest	(2) Pain mammary, above or below left breast
↓	↓
One or both arms, neck and jaw	Left scapula, left arm, and left side of neck
(3) Sensation of constriction, tightness or pressure	(3) Dull ache or soreness with "stabbing" or "shooting" pain
(4) Provoked by effort, mainly locomotion	(4) Provoked by worry and fatigue
(5) Relieved at once by halting	(5) Persistent for hours or days, little or slow relief by rest
(6) Usually feel well apart from pain	(6) Symptoms of general and neurotic ill health common

Other causes of thoracic pain.—Anginal pain has no monopoly of the sternal region, and almost any lesion of the mediastinum is capable on occasion of causing retrosternal pain. Apart from the information afforded by the history and physical examination, X-ray investigation should be a matter of routine in all forms of thoracic pain and will indicate or exclude many causes of pain in the chest, such as pneumothorax, mediastinal tumour, secondary neoplasm of the spine, while at the same time permitting inspection of the heart and aorta. The value of the electrocardiogram in diagnosis is considerable, for it can provide objective and valuable evidence of coronary occlusion, pericarditis, and pulmonary embolism, or help in excluding these conditions.

Spontaneous mediastinal emphysema is a rare cause of severe retrosternal pain simulating that of coronary thrombosis. Its diagnosis rests on the

if proved to be present, is easily countered by including sodium chloride (Ringer's solution) in the intravenous drip, which may have to be continued for some days in order to make sure that neither acidosis nor alkalosis develops, as is possible if the child is much dehydrated.

Post-operative treatment.—After the operation some definite regime must be laid down for feeding the patient for the first few days. At first only a very small quantity should be allowed at each feeding, beginning with 60 minim doses for the first twelve hours. During the next twenty-four hours, two-hourly feeds should be given and, after that, an ounce (30 gm.) or so may be taken every three hours in cases which are doing well. Some surgeons prefer glucose, 7½ per cent. in water, or half-strength normal saline for four to six hours after the operation before the milk is started. In about a week nursing at the breast may be resumed. Vomiting is liable to continue for a few days after the operation, presumably due to diminished gastric peristalsis. Continued vomiting after operation usually indicates that the constriction has not been sufficiently relieved. If breast milk is not available, skimmed, or partly skimmed cow's milk may be used with added sugar, or, preferably, lactic acid milk (lacidac), which may be either in half-cream strength or, better still, full-cream strength, provided the amount at each feed is carefully controlled.

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THE TREATMENT OF RINGWORM

THE treatment of ringworm depends more upon the site of the infection than the nature of the infecting organism. Thus ringworm on the smooth skin can be cured by almost any fungicide, whilst involvement of the hair can rarely be cured by applications, no matter how strong they are. It is essential before undertaking the treatment of any case of suspected ringworm to make absolutely sure of the diagnosis by confirming it microscopically. Many conditions resembling ringworm, such as intertrigo of the groin, nummular eczema on the limbs, and pompholyx of hands and feet, which are made worse by just those treatments used for ringworm.

RINGWORM OF THE SMOOTH SKIN INCLUDING THE GROIN

This is readily cleared by Whitfield's ointment but care must be taken that it does not cause a dermatitis; it is therefore safer to use it at half strength for sensitive areas such as the groin. A rapid, though drastic, treatment is dithranol, 0.5 per cent. in Lassar's paste. This should be applied for three to four days until the skin is peeling, after which a bland cream should be used. When dithranol is used in the groin the patient should be confined to bed. If there is marked vesication and weeping of the skin, as is found with animal ringworm, it is better to paint with 1 per cent. gentian violet until the acute phase has settled, after which one of the above or ammoniated mercury, 0.5 per cent. in Lassar's paste, should be applied.

RINGWORM OF THE SCALP

Except for rare cases of animal infection, ringworm of the scalp occurs only in children before puberty. The majority of cases are due to *M. audouini*; this is a human ringworm and can rarely be cured except by epilating the hair, which can only be done properly by X-rays or in young children by thallium acetate. Even with a localized patch of ringworm it is essential to epilate the whole scalp, or the infection will probably recur. Such epilation should be done by an expert and afterwards the child must be examined at fortnightly intervals by Wood's light in order to remove any hairs which have not epilated spontaneously, and also to be certain of a cure. The Wood's light, which makes hairs infected by ringworm fluoresce, should also be used to check all possible contacts, both in the family and in the school; by this means it is possible to detect even a single infected hair in a class of children. While the child is undergoing epilation it is wise to apply some

REVISION CORNER

THE TREATMENT OF CONGENITAL PYLORIC STENOSIS

WHEN a clear distinction has been made between pyloric spasm and established pyloric hypertrophy, the problem of treatment becomes quite clear. It is usually said that there is a tendency to spontaneous recovery in hypertrophic pyloric stenosis round about the sixteenth week, the symptoms having become ameliorated after the sixth week owing, presumably, to the muscles of the stomach becoming temporarily fatigued. But it is now generally recognized that death may occur from starvation in the meantime if medical treatment is resorted to, and that the risks of medical treatment are far greater than those of Rammstedt's operation, which consists in splitting the muscles of the pylorus without wounding the mucous membrane. Moreover, observations have shown that the shorter the period during which the vomiting has been present, the better the results of the operation. It may be said therefore that medical treatment may be tried in mild or early cases, provided rapid improvement takes place, the vomiting ceases and the weight begins to rise. In no circumstances should surgical treatment be delayed until the condition of the infant has so deteriorated that the risks of operation are increased.

MEDICAL TREATMENT

Medical treatment of cases of spasm consists in washing out the stomach with warm water or normal saline, regulating the feeding and making sure that dehydration is corrected. This may be sufficient, but it can be combined with drug treatment in the form of eumydrin (atropine methyl nitrate). It may be said that results have been rather more successful when this preparation has been used.

Eumydrin should be made up freshly each week and given half-an-hour before each feed, the average dose of which is 2.5 c.cm., although up to 4 c.cm. may be required. It is most important to remember that, should there be any evidence of dehydration, *intravenous saline and fluids* by mouth are essential. Continued lavage is not always indicated, and in most cases a preliminary treatment of this kind is all that is necessary for a day or two.

Feeding.—Breast milk, if available, is usually regarded as the ideal food, but in some cases even this is not successful and resort must be had instead to skimmed lactic acid milk with added sugar in the form of honey or dextri-maltose, or for the older children of this series a thickened cereal feed in the form of a paste, made according to the formula of Sauer, containing farina, skimmed milk and dextri-maltose. The amount of food given at one time should be small in the first place, and the intervals short or long as trial shows to be the better, three-hourly intervals being usually satisfactory.

Finally, it may be noted that some cases of spasm have appeared to respond well to the administration of *barbiturates* given alone or in combination with atropine.

SURGICAL TREATMENT

There can be little doubt that if the tumour has been felt, and there is undoubted visible peristalsis, operation should be resorted to as soon as possible. In other words, the eumydrin and medical treatment should be reserved for those cases in which the diagnosis is in some doubt, or in which there is slight visible peristalsis and the tumour is not properly felt, and in which vomiting is not persistently projectile.

The success of the operation has been shown in many statistics. For instance, Frew quotes that out of 100 active cases treated medically, 78 died, whereas out of a similar series operated on by Rammstedt's operation, 76 recovered.

Pre-operative treatment.—If operation is decided upon, one or two days' gastric lavage is often desirable as a pre-operative measure, but in all cases dehydration must be corrected by subcutaneous and, if necessary, intravenous therapy. Alkalosis,

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antiseptic ointment, such as dilute ammoniated mercury ointment, partly to destroy fungus but also to prevent infected hairs from flying about.

RINGWORM OF THE BEARD

This is usually an animal ringworm infection and occurs in farm workers and in those in contact with animals. Frequently it is a fierce inflammatory lesion or kerion, looking almost like a carbuncle; in this stage relief may be obtained by poultices. It is most important to remove all fungus as quickly as possible, and this is done by manual epilation of all the infected hairs. This is not so painful as it sounds, as infected hairs are loose and pull out very easily; this must be done every day until the whole area is clear. At the same time an antiseptic, such as 1 per cent. brilliant green or Whitfield's ointment, should be applied, and should be spread well beyond the lesion so as to prevent further infection.

RINGWORM OF THE FOOT

This is the ordinary athlete's foot and usually occurs between the little toe and the next, although it may spread more widely over the foot, especially in hot weather or in tropical climates. It is often confused with pompholyx of the feet and it is important to try and make a firm diagnosis by means of a microscopic examination of a scraping. In the acute phase the lesion must be treated gently by means of baths containing 1/4000 potassium permanganate, three times a day; in between, the feet should be wrapped with lint soaked in an oily calamine lotion. If the feet are painted with a dye at this stage, a lymphangitis often results. An alternative method is a soak of 0.5 per cent. silver nitrate; with this it is essential that the lint should be kept wet, and this necessitates fresh dressings every two hours. In the less acute form, the aim is to remove the infected horny layer, and this is done by Whitfield's ointment combined with the mechanical removal of the macerated epidermis, using a blunt scalpel. After about a week of this, the treatment should be changed to Castellani's paint or brilliant green, 0.5 per cent., and perchloride of mercury, 0.5 per cent. in industrial spirit, for a further period of a week. This alternation is then repeated for weekly periods until the skin is quite sound. There are numerous proprietary preparations, such as mersagel, which are cleaner to handle than the dyes, but the above is the most effective treatment; once the foot is apparently sound the patient should use a dusting powder containing 5 per cent. salicylic acid, as the fungus does not grow well in an acid medium. It is also useful every three months to use Whitfield's ointment for a week as a prophylactic measure. It seems probable that most recurrences are due to relapses and not to fresh infections; these may result from infected nails, which are very difficult to cure, even with removal of the nails, but the infection of the toes can be controlled with the above preventative measures. Patients with ringworm of the foot should not walk about barefoot in bathrooms and changing rooms, and they should have their own bath mats. They should wear cotton socks which can be boiled and the shoes should be disinfected by pushing a rag soaked in 10 per cent. formalin into the toes overnight; the shoes should be aired for twenty-four hours before being worn again.

RINGWORM OF THE NAIL

Ringworm of the nail is a very intractable condition and usually requires avulsion of the nail. This is best done by splitting the nail down the middle with a pair of scissors and then dissecting the halves away very carefully so as to avoid tearing the nail. The nail bed is then scraped, care being taken to avoid the nail matrix; the similar should be painted with pure carbolic and afterwards a fungicide, such as

Pre-operative ointment, should be regularly rubbed in until the new nail has grown. *lavage is often* this, recurrences are not infrequent and it may be necessary to must be corrected by sub-

THE MEDICAL USE OF DDT

MANY substances have been used as insecticides, but they can be divided into two main groups. First, those, like cyanide, which are poisonous to man and domestic animals as well as to insects; they have a limited use, and can be applied only by experts. The second group, containing substances like pyrethrum and derris, are much less toxic to mammals than to insects, and can be more widely used. Unfortunately in the past most of these were of vegetable origin, and the total world production was limited and rather small. The first point about DDT is that it is a chemical which can be synthesized fairly easily in large quantities, so that the present annual production is many times as great as the highest yield of pyrethrum from Japan and Kenya.

Quantity is not the only virtue of DDT. Most other insecticides were effective enough at the time of application, but soon afterwards they ceased to be lethal; thus a house fumigated with HCN could be reinfested with bed-bugs the next day, and a building sprayed with pyrethrum could soon again harbour houseflies and mosquitoes. On the other hand, DDT has a persistent effect. Many early reports have exaggerated this quality, but there is no doubt that clothing and buildings after proper treatment have remained "insect proof" for considerable periods.

DDT is an insect poison, but it can also be toxic to man. If ingested in large quantities in solution in oil it can cause death. If an oily solution is applied frequently to the skin some is absorbed and may endanger health. On the whole, however, the toxicity is not great, and with intelligent use DDT is harmless to man.

One disadvantage of DDT when compared with pyrethrum is the slowness with which it acts. Mosquitoes and flies sprayed with it appear unharmed for some minutes or even hours, although they may all die within the next day. If a rapid "knockdown" is required it is desirable to incorporate in the spray just enough pyrethrum with the DDT to anaesthetize the insects to prevent them from recovering activity.

TYPHUS

The louse, without which epidemic typhus cannot exist, was one of the first victims of DDT. Two different methods of application have been found effective. First it has been shown that shirts and undergarments may be impregnated with sufficient DDT to prevent the wearers from becoming permanently infested by any lice they may pick up, and this property is maintained even after laundering. Secondly, large numbers of people can be "deloused" without undressing by blowing a dust containing DDT among their clothing, and here again some degree of louse proofing is developed. DDT has made a great advance in louse and typhus prevention because it can be produced in sufficient quantities to treat the whole civil population of affected areas, and its persistent properties reduce the risk of reinfection.

The head louse is usually considered to be of little importance in the spread of typhus, but it is a serious nuisance even in Britain. "Lethane hair oil" has already been shown to be most effective, and has the same advantage of persistence as DDT. Unfortunately in Britain it is possible that lethane may be unobtainable, and therefore DDT emulsions, which are equally effective, should have a wide use.

MALARIA AND MOSQUITO-BORNE DISEASES

Soon after its recognition as an insecticide, DDT was shown to be particularly effective against mosquitoes. It has been used against both the aquatic larvæ and the flying adults. Dust or emulsions applied to the breeding places are most effective, and give more lasting results than other methods. The most spectacular application of this has been the dispersal of DDT from aircraft, by which means large tracts of country have been rendered virtually mosquito-free. It must be realized that this

technique is still in its infancy and may not have a widespread use in peace time.

DDT has been widely used against adult mosquitoes. The persistent properties, by which an application to walls leaves a film that will kill the insects alighting for weeks or months, have been much publicized. Unfortunately, although this is evidently most effective in some types of dwelling and against certain species of *Anopheles*, in various localities the results have been disappointing. When an insect alights on a surface covered with a deposit of DDT it obtains a dose of the insecticide on its legs. This does not normally cause death for some hours, but early work suggested that few insects survived. It has now been found that some species are excited by the presence of the DDT, and soon leave their resting place, so that the insecticide acts as "repellent". If the mosquitoes die, this repellent property is not a disadvantage, but some mosquitoes, alighting on particular surfaces treated with DDT, are stimulated to fly away before they receive a lethal dose. This may, in particular localities, greatly reduce the value of residual DDT. Sprays to kill mosquitoes and flies by direct application may contain DDT by itself, these are rather slow, so a small amount of pyrethrum is added as mentioned above.

HOUSE FLIES AND DOMESTIC PESTS

House flies are still best controlled by proper sanitary measures which reduce breeding by leaving little in the way of feces and similar matter available. DDT can be a useful adjunct, first as a spray, secondly as "residual DDT" which kills most flies which enter houses, and finally by treatment of infested manure by applying the insecticide where the young flies will be affected as they emerge after the pupal period. It is little use trying to reach the larvæ themselves as they are buried, and are anyway rather resistant.

Domestic pests.—DDT is effective against bedbugs and cockroaches. When a house is sprayed, the insecticide remains in the cracks on the walls in which bedbugs hide, so they are likely to be in contact for long periods with the DDT. The persistent properties of the insecticide also prevent reinfection of the building. The lethal dose to the cockroach is relatively high, but dusting of floors of infested buildings may be effective. The insects seem at first to be unaffected, and sometimes survive for days, but repeated dusting is usually successful.

ARACHNIDA

DDT seems to be less effective against arachnids. Thus its use against scabies is not recommended; substances like benzyl benzoate are much more effective. The arachnid vectors of disease (i.e. ticks carrying Rocky Mountain spotted fever, mites carrying scrub typhus) are difficult to kill with DDT.

GENERAL CONCLUSIONS

When information about DDT first became available, many people hailed it as a panacea which was going to control all insect-borne diseases without the need for further research. This was soon found to be untrue, and we can now see the substance in the proper perspective. DDT is undoubtedly a powerful addition to our armoury, and properly used will greatly help in the work of insect control. There are, however, many things it will not do, and it is obviously not the "last word". For some purposes another synthetic insecticide "gammexane" has been shown to have advantages, but for many problems DDT is still the best substance. But users must remember its limitations as well as its advantages.

A full account of this subject will be found in West, T. F., and Campbell, G. A (1946) "DDT The Synthetic Insecticide," London.

KENNETH MELLANBY, O.B.E., SC.D.

NOTES AND QUERIES

Aphthous Stomatitis

QUERY.—What is the etiology and treatment of relapsing aphthous stomatitis? The patient, an unmarried nurse, aged forty, has had relapsing ulcerations in her mouth (inside of lips, tongue, buccal mucosa) ever since she was twenty years of age. The condition started when she had her first artificial teeth fitted (she has had three sets of teeth fitted, in 1926, 1938, and 1946). The longest symptom-free period during these twenty years was twelve months, in 1943. The lesions are of regular circular outline (about $\frac{1}{2}$ inch in diameter) and have a shallow greyish base. The individual lesion starts as ulceration, is rather painful, does not easily bleed, gives rise to regional lymph gland swelling, does not cause excessive salivation, and subsides after two to six weeks (usually three weeks). As many as four ulcers may be present at a time but as a rule they are solitary. Her general health is good. There have never been any lesions elsewhere. The Wassermann reaction is negative, and a direct smear from the ulceration shows nothing unusual. Various dietary restrictions, vitamins in large doses (nicotinic acid, ascorbic acid, adexolin) and local treatment (H_2O_2 , $KMnO_4$, gentian violet, borax, bicarbonate of soda, iodine, tincture of myrrh and krameria, 1 per cent. silver nitrate, penicillin pastilles) have been tried without success.

REPLY.—There are two kinds of aphthous stomatitis; in one a shallow ulcer appears, 2 to 3 mm. in diameter, covered with a greyish or yellow exudate and surrounded by a narrow red inflammatory zone. The ulcers may be multiple and appear on the tongue or on any part of the buccal mucosa, although typically at the point of reflection of the buccal or labial mucosa from the bone. There is no deep tissue destruction and they heal without a scar. The other type, Mikulicz's aphthae, appear generally at the edges or on the dorsum of the tongue, although they also may rarely affect any other part of the buccal mucosa. A small nodule appears and in four or five days develops into an ulcer the size of a lentil. The lesions are punched out and are often multiple, showing marked tissue destruction. They heal in two or three weeks or longer, leaving a scar. They recur every four to six weeks and the edge of the tongue may become quite ragged. The etiology is obscure in both types. The former are said to be due to a virus, but only in susceptible people, and cannot be communicated to a healthy person, although vaccination from an existing ulcer is said to produce another in the same person. Similarly certain foods (e.g. nuts, cabbage, onions, salt, fermented cheese) will determine an attack in

susceptible patients. The Mikulicz type, which is chiefly confined to women, has been related to the menstrual cycle, but it can occur in men, and a case is reported in a man who was kept free by eliminating fresh milk and butter from his diet. Allergy, avitaminosis B and C and the internal secretions have, of course, been blamed, as also secondary anaemia and chronic dyspepsia. This form is rare and I have only seen it in otherwise quite healthy people. There is no specific treatment for either type. The patient must pay attention to the general health, especially avoid constipation, look out for a casual relationship with special foods, and when the ulcers appear may gain relief by having them touched with a trace of camphorated phenol carefully placed on the erosion twice in five minutes. An alternative preparation is Benain's solution (equal parts of phenol crystals, menthol and cocaine) used in the same way. The patient may touch the lesion with an alum pencil several times a day.

WILFRED FISH, M.D., D.Sc., D.D.Sc.

Psychogenic Factors and Peptic Ulcer

QUERY.—If it is agreed that psychogenic factors play an important part in recurrent attacks of peptic ulcer, is there any record of a surgical approach in the form of a sympathectomy and, if so, with what results? If not, is it likely that such a procedure would ever be justified?

REPLY.—Psychogenic factors certainly play an important part in recurrent attacks of peptic ulcer, but their influences are mediated by the vagus and not by the sympathetic nerves. Vagal activity increases the volume and activity of gastric secretion and augments the concentration of gastric enzymes. The tone of the stomach and peristaltic activity are also increased. Atropine, a vagal depressant, is commonly given to diminish the influence of the vagus. Bilateral vagotomy is now being performed for peptic ulcer but, although some preliminary results are encouraging, it is too early to know how successful this will prove. The problem of peptic ulcer is less in the healing of ulcers than in the prevention of recurrences, and the assessment of new methods of treatments is a long task. Division of the sympathetic nerves would have the reverse of the effect desired. There is no evidence that stimulation of the sympathetic nerves produces secretion of acid or pepsin, and indeed it may depress secretory action. Division of the sympathetic fibres in experimental animals results in an increase of gastric secretion from vagal predominance. It is possible that nicotine may have this effect by its inhibitory action on sympathetic nerves.

F. AVERY JONES, M.D., F.R.C.P.

technique is still in its infancy and may not have a widespread use in peace time.

DDT has been widely used against adult mosquitoes. The persistent properties, by which an application to walls leaves a film that will kill the insects alighting for weeks or months, have been much publicized. Unfortunately, although this is evidently most effective in some types of dwelling and against certain species of *Anopheles*, in various localities the results have been disappointing. When an insect alights on a surface covered with a deposit of DDT it obtains a dose of the insecticide on its legs. This does not normally cause death for some hours, but early work suggested that few insects survived. It has now been found that some species are excited by the presence of the DDT, and soon leave their resting place, so that the insecticide acts as "repellent". If the mosquitoes die, this repellent property is not a disadvantage, but some mosquitoes, alighting on particular surfaces treated with DDT, are stimulated to fly away before they receive a lethal dose. This may, in particular localities, greatly reduce the value of residual DDT. Sprays to kill mosquitoes and flies by direct application may contain DDT by itself, these are rather slow, so a small amount of pyrethrum is added as mentioned above.

HOUSE FLIES AND DOMESTIC PESTS

House flies are still best controlled by proper sanitary measures which reduce breeding by leaving little in the way of faeces and similar matter available. DDT can be a useful adjunct, first as a spray, secondly as "residual DDT" which kills most flies which enter houses, and finally by treatment of infested manure by applying the insecticide where the young flies will be affected as they emerge after the pupal period. It is little use trying to reach the larvæ themselves as they are buried, and are anyway rather resistant.

Domestic pests.—DDT is effective against bedbugs and cockroaches. When a house is sprayed, the insecticide remains in the cracks on the walls in which bedbugs hide, so they are likely to be in contact for long periods with the DDT. The persistent properties of the insecticide also prevent reinfection of the building. The lethal dose to the cockroach is relatively high, but dusting of floors of infested buildings may be effective. The insects seem at first to be unaffected, and sometimes survive for days, but repeated dusting is usually successful.

ARACHNIDA

DDT seems to be less effective against arachnids. Thus its use against scabies is not recommended; substances like benzyl benzoate are much more effective. The arachnid vectors of disease (i.e. ticks carrying Rocky Mountain spotted fever, mites carrying scrub typhus) are difficult to kill with DDT.

GENERAL CONCLUSIONS

When information about DDT first became available, many people hailed it as a panacea which was going to control all insect-borne diseases without the need for further research. This was soon found to be untrue, and we can now see the substance in the proper perspective. DDT is undoubtedly a powerful addition to our armoury, and properly used will greatly help in the work of insect control. There are, however, many things it will not do, and it is obviously not the "last word". For some purposes another synthetic insecticide "gammexane" has been shown to have advantages, but for many problems DDT is still the best substance. But users must remember its limitations as well as its advantages.

A full account of this subject will be found in West, T. F., and Campbell, G. A. (1946): "DDT The Synthetic Insecticide," London.

KENNETH MELLANBY, O.B.E., sc.D.

PRACTICAL NOTES

A Simple Method of Estimating Blood Ketones

A METHOD is described by R. M. Dumm and R. A. Shipley (*Journal of Laboratory and Clinical Medicine*, October 1946, 31, 1162), whereby acetone bodies in serum can be estimated with an error usually not exceeding 10 mgm. per cent., by the use of a simple technique employing a nitroprusside powder. The powder consists of:—

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Ammonium sulphate	20 gm.
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The three ingredients are mixed completely but are not ground together. The powder, if kept dry at all times, is stable for at least a year. The test depends upon the fact that the minimal blood level of total acetone bodies giving a definitely positive test (i.e., a prompt and distinctive purple colour) is approximately 10 mgm. per 100 c.cm. The test is carried out by adding a drop of serum to a small pinch of the powder, 5 mm. in diameter, lying on a white filter paper. If a positive reaction is obtained, then 1 c.cm. of serum is mixed with 1 c.cm. of distilled water and a drop of the mixture is added to a fresh pinch of the powder. If a positive reaction is still present, additional portions of distilled water are added until the test becomes negative. The last dilution giving a positive reaction multiplied by ten gives the blood ketone level. For instance, if the last positive dilution contained 1 c.cm. of serum and 6 c.cm. of distilled water, representing a dilution of 7, the blood ketones would be 7×10 , i.e. 70 mgm. per 100 c.cm. In a series of 25 tests, covering a range of blood ketones from 0-100 mgm. per 100 c.cm., it was found that, compared with accurate micro methods of estimation, the error with this simple method seldom exceeded 10 mgm. per 100 c.cm. It is pointed out that the degree of ketonuria does not always correspond to the degree of ketonæmia, and that in such cases this method provides a useful means of obtaining some idea of the level of the blood ketones, without elaborate laboratory apparatus.

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Parpanit in Diseases of the Extrapyramidal System

THE use of parpanit (diethylaminoethyl ester of phenylcyclopentan carbonic acid) in the treatment of sixty patients with diseases of the extrapyramidal system at the Medical Polyclinic, Zurich, during a period of eight months, is recorded by K. Hartmann (*Schweizerische Medizinische Wochenschrift*, December 14, 1946, 76, 1289). Parpanit ("G 2747": J. R. Giegy) is supplied in two strengths—parpanit forte, in tablets of 0.05 gm. quartered, and parpanit simple, in tablets of 0.00625 gm. The dosage depends largely upon the individual case, and patients must be watched carefully during the

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REPLY.—X-ray treatment in the neighbourhood of the scrotum would carry with it a certain risk if applied to a boy at the time of puberty. One would expect, however, recovery from the damage inflicted on the tubules after the passage of several years unless the dosage of X-rays was very considerable. It is unlikely that the treatment is entirely responsible for the azoospermia, for only weak doses are used in the treatment of eczema. Often no cause can be found in the present state of our knowledge for azoospermia, and the outlook is never very favourable. The right treatment would be first a testicular biopsy to determine the state of the tubules and then, if they are not found to be badly degenerated, a course of some anterior pituitary-like hormone, such as gestyl, in the hope of stimulating spermatogenesis.

KENNETH WALKER, F.R.C.S.

Brittle Finger Nails

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REPLY.—The most common cause of brittle finger nails is focal infection from pyorrhæa, root infection of the teeth, tonsillar infection, antral infection, or intestinal absorption. The affection usually occurs in persons of middle age and over, and goes with the so-called "rheumatic" diathesis. In all cases the above conditions should be excluded. If no area of

absorption can be found then an hereditary deficiency in nail formation must be assumed. The fact that mother and daughter are both affected rather points to this. Very little can be done in the way of treatment. The only drug which might help is arsenical solution B.P., 5 minims t.i.d., p.e., for at least six weeks. No local application is of any use.

R. CRANSTON LOW, M.D.

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REPLY.—Peripheral neuritis due to sulphonamides has been seen chiefly after ueron, sulphamerhythiazole and certain similar derivatives, which have now been discarded from clinical use on this account. One case following sulphadiazine was recorded by Little (*J. Amer. med. Ass.*, 1942, 119, 467), but such cases must be extremely rare. Degenerative changes have been seen histologically in the peripheral nerves and sometimes in the spinal cord. Clinically the condition consists of a peculiar form of peripheral motor neuritis of symmetrical distribution, affecting more especially the flexor muscles of the wrists, the interossei, adductor, and opponens pollicis, the flexors of the ankle joints and the external pterygoids. The paralysis is often of long duration. Usually the neuritis does not begin until one to three weeks after the end of a long or short course of one of the above sulphonamides; the first symptom is often pain, which lasts a few days, and the weakness appears a day or two after the onset of the pain. Treatment has generally consisted of withdrawal of the drug, and general palliative and orthopaedic measures until function gradually recovers, which may be sixty days or more. The present case is not like anything which has been described before, and although it may have been due to sulphadiazine, careful consideration should be given to the possibility of some other cause. Unless some other cause can be discovered, treatment would seem to be palliative, i.e. movements to prevent the fingers becoming fixed in extension, possibly electrical stimulation of the muscles to maintain their tone, and otherwise wait and hope for the paralysis to pass.

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first two days of treatment in order to assess the amount required. In the treated series the following regime was adopted:—An initial dosage of 0.0125 gm. three times daily (sensitive patients 0.00625 gm.), then an increase to 0.025 gm. (or 0.0125 gm.) three times daily. The dosage can be increased by a further 0.0125 gm. (or 0.00625 gm.) until the optimal dose is reached, but it is better to continue with a minimal active dose, and if this only proves active for a short time to administer the drug more frequently (five to six times daily). Single doses exceeding 0.075 gm., and daily doses of over 0.55 gm. were not employed. The drug was administered orally. The adjuvant use with parapanit of medicaments containing atropine was not found satisfactory, as frequently vertigo and increased tremor resulted therefrom. Ifova forte (luminal action), calcium, and sympatol were used for the treatment of vertigo, lassitude and feelings of oppression. Supplementary measures in the form of exercises, massage, and above all psychological influence, should not be neglected. The series included twenty-nine cases of post-encephalitic Parkinsonism; twenty-six with tremor and rigor, the rigor improving under treatment in all cases and the tremor in twenty-three; one case with rigor alone improved with treatment and two cases with tremor alone. Good results were also obtained in paralysis agitans, arteriosclerotic Parkinsonism, athetosis, morbus Wilson, and chorea.

Otitis Externa in the Tropics

A POWDER containing penicillin, sulphathiazole and boric acid powder is recommended by G. O. Dean (*U.S. Naval Medical Bulletin*, November 1946, 46, 1696) for the treatment of otitis externa in the tropics. The powder, known as "psb" powder, is made by mixing together equal parts of sulphathiazole and boric acid powders, and then adding sufficient penicillin to give the mixture a light yellow colour. The powder is placed in a powder blower and kept in a refrigerator ready for use at any time. The boric acid powder was incorporated in the powder in order to prevent deliquescence, but it is suggested that in temperate climates this addition may not be necessary and that the penicillin-sulphathiazole combination will remain dry for a considerable time. In treating a case of otitis externa, thorough but gentle cleansing and drying of the external auditory canal is essential. When this has been accomplished, the "psb" powder is blown into the canal so as to give a thin covering over the surface of the entire canal and the tympanic membrane. The process of cleansing, drying and blowing powder into the canal is repeated daily

until the inflammatory condition has subsided. Even when apparently all the inflammation has been controlled it is advisable to repeat the insufflation at weekly intervals for four or five weeks.

Mercurial Antiseptics in Skin Affections

PHENYL mercuric chloride and acetate, in the forms of ointments, a calamine lotion, a powder, and a simple solution have been used in the treatment of 500 cases of skin lesions in the tropics by F. A. J. Byrne (*British Medical Journal*, January 18, 1947, i, 90). The ointments employed were 0.125 and 0.2 per cent. phenyl mercuric chloride and acetate in eucerin base:—

The phenyl mercuric acetate is dissolved in water at a temperature of 85° C., the solution is melted and kept at a temperature of 55° C., and added slowly to the solution while it is still warm, and stirred until cool. In the preparation of the phenyl mercuric chloride ointment the drug is incorporated in the melted eucerin at 55° C., with careful trituration and keeping the contents of the mortar heated at 55° C. by means of a water bath, and then, after the drug is evenly dispersed, adding distilled water (heated to 85° C.) in small quantities, stirring rapidly until cool.

A calamine lotion of the following formula was also employed:—

Phenyl mercuric chloride 0.5 per cent. precipitated on calamine	15 grains (1 gm.)
Zinc oxide	30 grains (2 gm.)
Glycerin	30 minims (1.8 c.c.m.)
Distilled water	to 1 ounce (29.4 c.c.m.)

The solution used was phenyl mercuric acetate in 1:8000 concentration:—

2 gm. phenyl mercuric acetate is heated in 250 c.c.m. hot distilled water and the almost boiling solution is poured into 750 c.c.m. cold distilled water.

The calamine powder contained 0.5 per cent. phenyl mercuric chloride. In the treatment of all reasonably dry lesions phenyl mercuric chloride ointment was applied on lint for three to four hours, any excess ointment being wiped off at the end of this time. An ointment of 0.125 per cent. strength was sufficient in the treatment of *tinca cruris, corporis* and *capitis*; the affected areas were slightly red and itching for twenty-four hours after the application, after which time the lesion began to fade, and in five to six days the skin was normal. In resistant cases a second application, using an 0.2 per cent. ointment, was made for three hours. In the treatment of moist lesions the application of the ointment was followed by phenyl mercuric chloride calamine lotion, and in two or three days the infection was controlled and rapid healing occurred. In *epidermophytosis of the feet*, after cleansing the interdigital spaces and removing dead skin, 0.5 per cent. phenyl mercuric chloride powder was applied to moist areas, and after drying 0.125 ointment twice daily. To prevent reinfection, socks should be

steeped for an hour in 1 : 20,000 phenyl mercuric acetate solution before washing, and boots and shoes should be sprayed inside with a 1 : 2000 alcoholic solution of phenyl mercuric acetate. In *epidermophyton inguinale* the ointment was applied for four hours with thorough lunction, including the spreading edges: strips of lint coated with the ointment were applied to the lesion and fixed in position with pads of cotton-wool and a double T-bandage. In five to six days the skin became normal. For the treatment of *jungle sores* compresses of 1:8000 phenyl mercuric acetate solution were applied for twenty-four hours to sores in forward areas and small sores of recent origin, with resulting complete disinfection of the sore; the skin was then painted with the solution, and "elastoplast" applied. For large chronic sores disinfection with 1:8000 compresses was carried out for twenty-four hours, then a normal saline compress for a further twenty-four hours, followed by skin grafting. No toxic effects or evidence of skin sensitivity were noted in the treated series, apart from slight and temporary vesication in some patients, especially those of fair or auburn colouring; after twenty-four hours this disappeared leaving a clean healthy skin. It is emphasized that the method of application and the duration must be strictly adhered to in order to obtain satisfactory results.

Submucous Injections of Phenol in Rhinitis

FIFTY cases of vasomotor and allergic rhinitis, all of which had proved resistant to other forms of treatment, i.e. desensitization, ephedrine by mouth and nasal spray, oral calcium gluconate, linear cauterization of the inferior turbinates and local cauterization of sensitive spots, and zinc ionization, were treated by injections of phenol in arachis oil (M. Marks: *Journal of Laryngology and Otology*, May 1946, 61, 282). The method used was as follows:—

The anterior end of the inferior turbinate is painted with cocaine at the proposed site of injection. Using a 5 c.cm. syringe (preferably of the Labat type) with a long wide-bore needle, the needle is thrust deeply into the cavernous tissue of the inferior turbinate as far as the posterior end; then, while slowly withdrawing the needle, 2 c.cm. of a 5 per cent. solution of phenol in arachis oil are injected. The procedure is repeated on the other side. After adequate injection the inferior turbinate should appear blown up, completely filling the lower part of the nasal cavity. The injection, which is stated to be quite painless and to cause no after-effects, may have to be repeated one week later. A week after injection the turbinate appears shrunken and of normal consistency.

Of the fifty cases reported, 92 per cent. of the twenty-five cases of vasomotor rhinitis were symptomless after treatment, and of the twenty-five allergic cases freedom from symptoms

resulted in 68 per cent. In one case of vasomotor rhinitis, with nasal obstruction and anosmia of ten years' standing, two injections of 2 c.cm. of phenol into each turbinate at one week's interval resulted in complete disappearance of the nasal obstruction with return of the sense of smell and restoration of a good airway. In a case of allergic origin, in a twenty-six year old man discharged from the Forces on account of headaches, nasal obstruction and rhinorrhœa, in whom desensitization and other treatment had failed, two injections of phenol resulted in disappearance of the sneezing and headaches and a considerably increased airway.

A Method of Preventing Contamination of Syringes

It is now well recognized that a syringe may become contaminated following a parenteral injection and that this contamination may be responsible for spreading infection from one patient to another. By experiments carried out on patients, R. R. Hughes (*Journal of the Royal Army Medical Corps*, October 1946, 87, 156) has shown that, even with the most careful technique, such contamination may be heavy and that three factors are responsible for it: (1) back pressure forcing fluid from the tissues into the needle; (2) spread of blood by diffusion from the tip of the needle towards the syringe; (3) suction when removing the needle from the syringe aspirating the needle contents back on to the nozzle of the syringe. It is clearly impracticable, when giving a large number of injections, to use a fresh syringe for each injection, and Hughes recommends the following technique to overcome this practical difficulty and at the same time to ensure that contamination of the syringe should not occur.

The syringe having been filled with the solution to be injected, a two-way tap is fitted on the syringe and the needle is fitted to the tap. After the injection has been given, and before the pressure on the plunger is relaxed, the tap is turned off, which results in the needle no longer being connected with the syringe. The needle is then withdrawn from the tissues, the tap and needle removed together from the syringe, and a freshly sterilized tap and needle are fitted for the next injection. The used needle and tap can be rinsed and rapidly sterilized by boiling.

Using this technique, no contamination of the syringe was found in a series of 99 injections, compared with a contamination rate of 34 per cent. in a series of 114 intramuscular injections made with a needle and syringe without a tap. A two-way tap was used in this investigation because this is the standard issue in the Army, and it is suggested that for civilian use an ordinary single tap without a side-tube would probably be just as efficient.

REVIEWS OF BOOKS

Peripheral Vascular Disease. BY EDGAR V. ALLEN, M.D., M.S., F.A.C.P., NELSON W. BARKER, M.D., M.S., F.A.C.P., and EDGAR A. HINES, Jr., M.D., M.S., F.A.C.P. London and Philadelphia: W. B. Saunders Co., 1946. Pp. xii and 871. Figures 387. Price 50s.

THIS product of the Mayo Clinic is an example of team-work at its best. The three senior authors have been assisted in their task by a team of eleven collaborators. The result is the most authoritative textbook on this subject that has yet appeared. The whole field of peripheral vascular disease, including both the arteries and the veins, has been covered with a thoroughness that is wholly commendable. The value of the book is considerably enhanced by the practical manner in which the subject is presented. This is no theoretical or academic exposition, but a record based upon extensive personal experience, and the authors have not been afraid to criticize where criticism seemed necessary. The introduction to the chapter on "Medical Treatment and Special Techniques" (pp. 703 to 705) might well be reprinted and presented to every research worker, particularly clinicians, who proposes to publish an article on the results of treatment. Outstanding among the chapters are those dealing with thromboangiitis obliterans and Raynaud's disease. Where so much is so good it may appear ungrateful to criticize, but it is disappointing to find periarteritis nodosa dismissed in so small a space. The chapter on erythema nodosum is scarcely in conformity with modern views, and the authors fail to justify their claims for the value of tissue extracts in the treatment of intermittent claudication. These, however, are small blemishes in a work which no physician or surgeon can afford to ignore. It will clearly remain the standard work of reference on a difficult and important subject for many years to come.

The Pathology of Traumatic Injury. BY JAMES V. WILSON, M.D., M.R.C.P., With a Foreword by P. H. MITCHNER, C.B., C.B.E., M.D., M.S., F.R.C.S. Edinburgh: E. & S. Livingstone Ltd., 1946. Pp. xi and 192. Figures 61. Price 20s.

THIS book consists of a series of essays on the pathological changes resulting from injury. Part I deals mainly with the constitutional effects of injury, including shock, fat embolism, the crush syndrome and wound infections: part II with the local effects in such injuries as

those of the blood vessels, brain, chest and abdomen. The author presents these various subjects admirably, with the practical background of his own war service in the Middle East and yet with a full appreciation of the theoretical aspects. He writes with an easy pen, and sets forth the present-day views with admirable clarity. The book is well illustrated, and in production and format maintains the high standard to be expected of its publishers. It should be of especial value to surgeons preparing for a higher diploma.

Diseases of the Heart and Circulation. BY A. A. FITZGERALD PEEL, M.A., D.M., F.R.F.P.S. London: Geoffrey Cumberledge, Oxford University Press, 1947. Pp. xxi and 398. Figures 61. Price 35s.

THERE are so many first-class textbooks of cardiology that a new entry to the field must expect to be judged by a correspondingly high standard. Whilst this latest addition to the list will not take a high place in the hierarchy of cardiological literature, it is not without its merits as an introduction to the subject for the student and practitioner. The outcome of fifteen years' experience in the teaching of medical students in Glasgow, it does succeed in giving, on the whole, a balanced survey of the subject. Like so many of his fellow cardiologists, the author has devoted too much space to electrocardiography, with the result that important practical aspects of cardiology, such as heart disease in pregnancy and operative surgery, do not receive the attention they deserve. It is rather disconcerting in a new textbook to find a differentiation made between relative and absolute cardiac dullness, whereas no mention is made of the necessity for locating the upper border of liver dullness before beginning to outline the right border of the heart by percussion.

Ambulatory Proctology. BY ALFRED J. CANTOR, M.D. London: Hamish Hamilton Medical Books, 1946. Pp. xv and 524. Illustrations 275. Price 42s.

ALTHOUGH the title of this book is not a very happy one, since it suggests that the proctologist rather than the patient is ambulatory, it contains a great mass of material. The author is a distinguished physician who has previously contributed much of originality to the study of disease in the intestines. His description of the examination of patients suffering from rectal and colonic disease is excellent and suited in general

the consulting room. His account of minor therapeutic procedures, such as the injection of hemorrhoids, is also admirable. He describes the operations of excision of hemorrhoids, the correction of prolapse and the treatment of anorectal suppuration as procedures which may be performed in the consulting room upon the ambulant patient; few proctologists, physicians, surgeons or patients in this country would go so far. The waiting lists of our hospitals and pursuing homes are so full that the motto *solvitur ambulando* has had a wide application and is not likely to be extended further anytime in the field of proctology. The American approach to specialization is implicit in Dr. Cantor's assertion that he is an advocate of the "newer school of thought (which) advocates inclusion of all abdominal colonic surgery, even to appendectomy in proctology". In England we would say rather that proctology should be adopted as a speciality only by surgeons experienced in abdominal work. The details of the examination and investigation, however, ensure that this book will be valued by the general practitioner who wishes to investigate his patients so far as possible in his own consulting room no less than by the surgeon who engages in rectal work.

The Nature of Disease up to Date. By J. E. R. McDONAGH, F.R.C.S. London: William Heinemann (Medical Books), Ltd., 1946. Pp. xvi and 168. Figures 13. Price 15s.

ON the wrapper of this book it is claimed that the author "has proved by countless tests and experiments on animals and human beings the truth of the ancient dictum 'The Blood is the life'". The reader will look in vain for any account of these experiments. Instead he will find a fantasy of high-sounding, meaningless phrases woven into an unintelligible chaos of jargon which must be the mental equivalent of "doodling". The effect is rather like some modern poetry, in which disconnected words are strung together without apparent reason. For example, the action of penicillin is thus described:—"The amino groups over-expand, in particular, dead staphylococci directly and live staphylococci indirectly, by expanding the host's over-contracted protein. The carboxyl groups act by contracting the over-expanded protein". The clinical sections of the book show that the writer is only concerned with the mystical hinterland of dieting and colonic lavage, which, strangely, will convert a positive Wassermann to a negative! Indeed, to quote the author—"Taking this view simplified con-

siderably the treatment of disease. Indeed, it narrowed it down to placing the patient upon the proper diet, to washing out the large intestine, to correcting the osteopathic lesions to which the intestinal toxæmia had given rise, to employing F. M. Alexander's re-educative method to help maintain the corrections made, to restoring the rhythm to its normal course in the cycles it describes in the protein, and to immunizing the patient against the activity of the micro-organisms which help to keep the intestinal toxæmia active". It is, to put it mildly, difficult to understand why, when medical students are unable to acquire even standard medical textbooks, that paper should be made available for this type of publication.

NEW EDITIONS

AMONG the new additions to *Diseases of the Nervous System*, by F. M. R. WALSHE, M.D., D.Sc., F.R.C.P., F.R.S., in its fifth edition (E. & S. Livingstone Ltd., 16s.) is the use of penicillin in the treatment of meningitis, and new material in the chapter on vascular disorders of the brain. The new edition is well produced and the format is an improvement on the previous edition produced under the constricting limitations of war-time economy.

Allergy, by ERICH URBACH, M.D., F.A.C.A., and PHILIP M. GOTTLIEB, M.D., F.A.C.A., in its second edition [Wm. Heinemann (Medical Books) Ltd., 70s.] has been enriched by the addition of much new material, among which are sections on allergic bronchitis and cough, the Rh factor, and psychosomatic allergy. Although less than three years have passed since the publication of the first edition extensive revision has been carried out: thiouracil and penicillin have been included in the section on drug allergy, and there is an interesting section on toxic and allergic dermatitis. These are mere examples taken at random from a work dealing with all aspects of allergy, richly illustrated, with a splendid bibliography and beautifully produced.

The 1946 Year Book of General Medicine, edited by GEORGE F. DICK, M.D., and his colleagues (The Year Book Publishers, Inc., Chicago, H. K. Lewis & Co., 21s.) contains much new information on the antibiotic streptomycin and its clinical uses, on DDT, and on blood transfusion. Well referenced and illustrated, and covering an extraordinarily wide field within a limited space, this little book supplies the answers to many problems in general medical practice.

NOTES AND PREPARATIONS

EDITORIAL ANNOUNCEMENT

The Editors of *THE PRACTITIONER* have always endeavoured to provide those in general practice not only with the kind of journal that they need, but also to ensure that it should reach them punctually. It is therefore with considerable regret that they have to announce that the fuel crisis has caused delay in the publication of the present number and may interfere with the prompt appearance of the ensuing numbers. As soon as conditions permit the journal will appear, as heretofore, on the first of each month.

NEW PREPARATIONS

CHLORBISMOL brand of bismuth oxychloride injection, a slowly absorbed and eliminated suspension of bismuth oxychloride, has been prepared for use as a supplement to injections of arsenicals or penicillin in the treatment of syphilis. A booklet dealing with this preparation is now available to members of the medical profession on application to the manufacturers, May & Baker Ltd., Dagenham, Essex.

"DIALOQUIN" brand diiodohydroxyquinoline, is a tasteless, non-toxic compound containing 63.9 per cent. iodine, and is stated to possess high protozoacidal potency. It has been prepared for the treatment of amebiasis and trichomoniasis, and clinical trials have so far indicated its value in cases of amebiasis which have for the time being become emetine-resistant. Dialoquin is issued in bottles of 100 and 1000 tablets of 0.21 gm. (3.2 grains), by Savory & Moore Ltd., 61 Welbeck Street, London, W.1, from whom literature can be obtained.

BRITISH COMMONWEALTH AND EMPIRE HEALTH AND TUBERCULOSIS CONFERENCE, 1947

A CONFERENCE on Tuberculosis, arranged by the National Association for the Prevention of Tuberculosis of Great Britain, will be held in London from July 8 to 10 inclusive. Representatives from all the Dominions and Colonies have been invited, and it is also hoped that many visitors from other countries will be present. Full particulars can be obtained from the Secretary-General, National Association for the Prevention of Tuberculosis, Tavistock House North, Tavistock Square, London, W.C.1.

"TECHNIQUES HOSPITALIÈRES: SANITAIRES ET SOCIALES"

THIS journal deals with all aspects of social medicine and hygiene, and well presents the activities for social betterment which are being carried out by our French colleagues. Infant and maternal welfare, social hygiene, model farms for the production of pure milk, hospital reconstruction and organization, are among the

subjects covered. The journal is well produced and illustrated, and should prove of great interest to British practitioners and medical officers. The journal is published in Paris (XVe), 6 Square Desaix, but is available at the scientific library attached to the Institut Français, Queensberry Place, London, S.W.7, where it can be consulted or borrowed by post.

OXYGEN IN WAR AND PEACE

THIS is the title of a book published by the British Oxygen Company Ltd., dealing with the various uses of oxygen in its many forms during the recent war and the adaptation of these measures to post-war uses. The many uses to which oxy-acetylene processes were put are surprising in their number and ingenuity, and those who are fortunate enough to obtain a copy will find that it provides most interesting reading. Application should be made to the British Oxygen Company Limited, Grosvenor House, Park Lane, London, W.1.

THE HOME AMBULANCE SERVICE

THE 1946 edition of the Register of Ambulance Stations, issued by the Joint Committee of the Order of St. John of Jerusalem and the British Red Cross Society, contains, in addition to particulars of the types of service available, the addresses and telephone numbers of all Stations in Britain, Northern Ireland, the Channel Isles and the Isle of Man. The address of the Joint Committee is 12 Grosvenor Crescent, London, S.W.1.

"MEDICAL BOOKMAN"

THE first issue of the *Medical Bookman* appeared in January of this year. As its title indicates, the journal deals with medical literature in the form of reviews of medical books by experts. Published monthly, by Harvey & Blythe Ltd., 6 Hanover Square, London, W.1, price 6d. per copy (7s. 6d. per annum), it can be obtained either direct from the publishers or through any bookseller.

The contents for the April issue, which will be a special number on "Sex and its Disorders", will be found on page lxiv at the end of the advertisement section.

THE PRACTITIONER

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SEX AND ITS PROBLEMS

INTRODUCTION

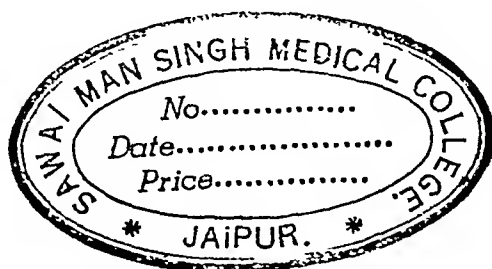
LIFE depends upon the perpetuation of species, which in turn depends upon the survival of individuals long enough to reproduce their kind. Self-preservation, by seeking nourishment and avoiding harm, and self-reproduction, are thus the primary urges of all living creatures, whether plants or animals. In man, fear, hunger and sex are still dominant, for all his intellectual overlay; but whereas the fear of danger and the need for food are universal, and form a common bond between men of all ages, the urge to reproduction appears in each individual unheralded and imperfectly understood, yet potent to change his appearance, his character, his reactions to every aspect of the life around him.

The sex instinct, unconcealed and freely exercised as it is in animals and primitive man, can lead to strange exaggerations of behaviour, to vain-glorious struttings that look ridiculous to the beholder not similarly impelled, to self-effacing devotion, to mortal combat among the peaceful and sublime courage in the timorous, to wild elation, and suicidal depression. In civilized communities the same instinct, having lost much of its spontaneity but none of its power, underlies many of the troubles of mind and body with which the medical practitioner must deal. The growth of human organization from the family to the tribe, from the tribe to the community, from the community to the nation, has brought the need to subject the desires of the individual to the welfare of society, and the simultaneous development of art and industry has emphasized the intellectual at the expense of the instinctive aspects of personal relationships. In a society that has found it necessary to restrain the free play of sexual instincts for the common good, the frank discussion of sex matters has, in consequence, been suppressed also. Man, trying to convince himself that he is a creature of reason, must find explanations for his action, noble or ignoble, other than the drive of what he considers an animal instinct. This transference of a process that is innate in everyone to an underground level where it may not be spoken about freely, has led to the bawdy limerick, the suggestive joke, the salacious wit of the roadhouse cocktail bar, and often to repressions, unnatural vice, and every form of psychosomatic disturbance in those who cannot indulge in this verbal outlet. The same reticence has prohibited a frank discussion

of sexual disorders, their cause and their remedy, even in the medical press. That the problem is a real one, on which practitioners are anxious to voice their own difficulties and to hear the experiences of others, is shown by the great volume of correspondence on the subject that has appeared in the weekly medical journals during the past few months.

The literature of sex is, unfortunately, largely the literature of the abnormal. Those who are readiest with tongue and pen are the abnormal minority, concerned with sex as a source of frustration, or as a means of self-expression or self-qualification, rather than with sex as a natural communion between two people. Happy sex life is so common, and accepted so unthinkingly, that the great mass of normal men and women who make up the family life of the country and form the bulk of public opinion, feel no need to express in words a satisfaction that is instinctive, and are unwilling, indeed often unable, to do so if called upon. Yet all would agree with Ruskin: "Each sex has what the other has not; each completes the other, and is completed by the other. They are in nothing alike, and the happiness and perfection of both depends on each asking and receiving from the other what the other only can give".

In this issue we have endeavoured to deal with the chief problems that present themselves as disorders of sex, and to enlist the help of a group of writers who have practical experience of these problems, and practical views as to how they may be solved or alleviated. We count ourselves fortunate in being able to put forward the views of the Bishop of London, who has long been known for his kindly and understanding outlook on the difficulties of the modern world, and of the Right Hon. Henry Willink, a distinguished lawyer and the Minister of Health from 1943 to 1945, in addition to contributions by members of our own profession who can speak with authority on those aspects of this problem with which the general practitioner is most commonly called upon to deal.



MORALS AND SEX

A CHRISTIAN VIEW

By THE BISHOP OF LONDON

THE relation between morals and sex has been brought vividly before the public through the recent revelation of the quite appalling increase in petitions for divorce. Speaking in the House of Lords, the Lord Chancellor expressed grave concern at the present figures. He pointed out that whereas in 1905 the number of cases was 670, ten years later it had nearly doubled; in another ten years it had more than doubled again; ten years later still it had reached 5,000, and in 1945 the number had increased to five times that figure, namely, 25,000. His estimate for 1946 was 38,000 and for 1947, 50,000.

The lawyers are naturally concerned at the difficulty of dealing with so rapid an increase in their work. The sociologists are even more concerned because they realize that if this goes on it will mean in effect the destruction of that family life which is the foundation of society. Schoolmasters are troubled because they say that they can tell at once from the demeanour of boys returning to school when there has been some such disaster in their home. Physicians recognize more clearly than the rest of us that in such cases a trauma may be inflicted upon the mind of a child as serious in its possible effects as the loss of a limb. The clergy are troubled because of the departure from traditional Christian morality and because of the disintegrating effects it is likely to have upon individual character.

The revelation of these figures has shocked the whole community. Many are asking whether a mistake has not been made in this surrender of formerly accepted standards, and are beginning to inquire whether there is not something in the Christian teaching which might have prevented this disaster and to which a return must be made if a remedy is to be found. It is obvious that we are standing perilously upon the edge of an abyss: *facilis descensus averno*. If there is not a speedy change of mind we may easily find ourselves involved in almost irretrievable ruin.

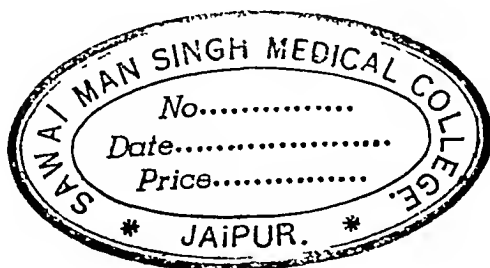
MARRIAGE

The traditional Christian view of marriage is that it is a lifelong relationship of one man to one woman which can only be dissolved by death. In other words, generally speaking, the Church does not recognize divorce and will not countenance the marriage of a divorced person so long as the partner of the original marriage is still living. This is not so unrealistic an attitude as is sometimes imagined. The Church is quite aware that married people sometimes break their vows of fidelity, but she does not regard this as sufficient reason for dissolving the marriage. We lay great stress upon the virtue of forgiveness, and we believe that this is not just a question of forgetting the past, but is rather a creative effort of reconciliation and renewal.

of sexual disorders, their cause and their remedy, even in the medical press. That the problem is a real one, on which practitioners are anxious to voice their own difficulties and to hear the experiences of others, is shown by the great volume of correspondence on the subject that has appeared in the weekly medical journals during the past few months.

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In this issue we have endeavoured to deal with the chief problems that present themselves as disorders of sex, and to enlist the help of a group of writers who have practical experience of these problems, and practical views as to how they may be solved or alleviated. We count ourselves fortunate in being able to put forward the views of the Bishop of London, who has long been known for his kindly and understanding outlook on the difficulties of the modern world, and of the Right Hon. Henry Willink, a distinguished lawyer and the Minister of Health from 1943 to 1945, in addition to contributions by members of our own profession who can speak with authority on those aspects of this problem with which the general practitioner is most commonly called upon to deal.



impediment; second, publicity, and third, consent. The absence of impediment means that there must be nothing which would make a marriage *ipso facto* impossible; neither of the parties must be involved in an already existing marriage, the parties must not be related to each other within certain degrees of consanguinity, and so on. Publicity implies that there must be witnesses. The actual contract is, of course, between the parties concerned; the officiating clergyman acts both as the agent of the Church in blessing the union and as the agent of the State in endorsing the certificate. The question of consent is of the greatest importance: if either of the parties is forced into the contract against his or her will the marriage is not valid. The emphasis on full and free consent is of fundamental importance because it is consent and not, as is sometimes thought, consummation that makes the marriage.

The plea of nullity.—There is one point arising out of this account of valid marriage which it is particularly desirable to bear in mind in view of the present situation. A certain proportion of cases that come before the Divorce Courts would, from the point of view of the Church at least, be better entered as pleas for nullity. It is generally understood that lawyers are less ready to advise their clients to plead for nullity than for divorce. It is much to be hoped that if this is true a change in legal practice will soon be made. Certainly it would ease the position from the ecclesiastical point of view, for if an original marriage has been proved to have been no marriage at all there is no reason why the clergy should not conduct a fresh marriage. An alternative would be for the Church to set up her own Courts to decide the question of nullity; but the Church of England, at least, has no desire to do that, and would indeed only do it as a last resort. It would therefore be generally welcome if lawyers would recommend that when a plea for nullity can be properly entered the additional difficulty and trouble that such plea might entail should be definitely faced. It is possible, moreover, that the grounds for nullity might be extended beyond those already recognized in law.

SOME CAUSES OF PRESENT-DAY IMMORALITY

Much of our present trouble arises at a stage further back than the actual marriage. We are woefully ignorant of the right relations between the sexes and of the steps that should lead to marriage. It is almost incredible that a nation which has arrived at our boasted pitch of civilization and culture should allow its youth to suffer from such a miserable lack of guidance with regard to things so vital to their well-being. Love, courtship and marriage together form the most enthralling adventure of most human lives, but comparatively few young people receive any adequate help towards understanding even the first of these steps.

Every normal youth wishes to know how he or she can distinguish the signs that indicate whether they have truly "fallen in love". Mostly in these days they are left to judge from such indications as are given them in

The cynic may smile, but he is the least practical person in the world. We have enough actual evidence of the effect of forgiveness to realize its tremendous importance in domestic relations. There is probably no priest of experience who could not point to a number of marriages where such forgiveness has been exercised and has led to the complete re-establishment of happy marital life. This is not to say that the Church condones adultery—far from it. In the eyes of Christians it is a most grievous fault, but we believe the influence of forgiveness to be so powerful that it can heal even the wounds caused by such a betrayal.

It is indeed somewhat paradoxical that the very people who normally attach least importance to the crime of adultery should nevertheless regard it as a sufficiently strong reason to break up a marriage. One of the greatest difficulties in the present situation arises from the fact that nowadays there are so many who appear to regard a plea for divorce as the inevitable consequence of the discovery of infidelity. This is one of the most significant indications of the present departure from Christian standards. We shall never restore the situation until there is a fresh grasp of the Christian teaching about forgiveness.

It is also necessary that there should be a fresh realization of the nature of marriage itself. The clergy are instructed to see that couples who come to be married in church shall understand the true character of the state they are about to enter. The opportunity of instruction, however, is all too short; and in the case of those who are married in a Registry Office there is apparently no instruction at all. It is questionable whether any society based upon the family can afford to allow its citizens to enter upon a marriage without ensuring that they understand the nature of the contract. It is, for instance, not at all clear that people who marry at Registry Offices understand that the State as well as the Church regard marriage as a lifelong contract. Although the State presumes to recognize that in certain cases the contract may be dissolved, nevertheless, its own basic doctrine is that the contract is for life. It is on that ground, of course, that the Church can recognize a State marriage as valid.

The Christian view of the purpose of this contract is stated in the Anglican formulary as threefold. It is for the procreation of children, the regulation of sexual union, and the mutual society, help and comfort that the one ought to have of the other. It is recognized of course that not all these purposes may be fulfilled, and that in some cases they cannot all be fulfilled. Nevertheless, it is assumed that the contracting parties have the intention of fulfilling them all in so far as nature and grace make them possible, and it is on that assumption that the Church witnesses the contract and gives its blessing to the contracting parties.

A bare enumeration of the ends to be fulfilled does not in itself explain what constitutes a valid marriage in the eyes of the Church. This is not always understood and may require some elucidation. There are three things necessary for a valid marriage: first, the absence of any diriment

it is subjected to controls of every kind, asserts the last relic of its pride in this claim to moral irresponsibility. It is an extraordinary paradox, reminiscent of Kipling's demented lighthouse keeper who became so obsessed by the sight of the ships passing always in the same confined channel that he removed the buoys marking their course. He got a break in the monotony of his existence, but he made universal shipwreck. It is possible that we shall see a good deal more wreckage of personal lives and social standards before a new generation becomes alive to its error and restores the old and well-tried guiding signs.

THE BASIS OF CHRISTIAN ETHICS

Already there are some faint intimations that the process of restoration is about to begin. It is being asked whether after all Christianity might not have some remedy for the present chaos. We may therefore conclude by asking what is the basis in Christian thought for the conception of marriage which is traditional in the Church and has already been outlined above.

The basic teaching of Christian ethics is that all human beings owe a duty of love towards each other. This love is not a matter of the emotions but the fixed determination to serve the best and highest ends of all people whatsoever. It does not matter whether they are friend or foe, whether they are likeable or not: we have still to serve them. It is against this background that sexual love is to be set. Such love is a particular instance of this intention of service reinforced by feelings of affection deepening into mutual desire. It is obvious that such a mental attitude will have as its main constituent the wish to give rather than to get; it will be compatible with careful consideration as to suitability; it will be anxious to be assured that it can assist the prospective partner to achieve his or her own highest ends. Each will desire to procure the greatest possible happiness of the other. For religious people this can only be done in a framework of religion, for without spiritual satisfaction the highest ends cannot be attained.

When sexual union is entered upon in this spirit it is believed that there is inaugurated a union of personality of which the union of the two bodies is only a faint analogue. The unity of personality in marriage is the relationship which St. Paul describes as "a great mystery", and which he compares to the mystical union between Christ and His Church. Thus in his belief there is a union of the spirit as well as of the flesh in marriage. That union normally grows closer and closer as the pair live together faithfully and lovingly. Of course there can exist no scientific proof of this invisible unity, any more than there can exist a scientific proof of love itself. But at least that is St. Paul's claim, and many happily married couples affirm its truth. When these claims are accepted, it is the belief of Christian people that sufficient help is given to enable the ideal to be attained. Outside Christianity there is not likely to be much more than an approximation to it. Christian people, however, must maintain the excellence of the ideal. They must encourage everyone to strive to attain it, believing that when the effort is made, supernatural help will be given towards its attainment.

Hollywood films; and a less sure guide it would be impossible to imagine. From such a source they learn that love is an overwhelming impulse without rhyme or reason which must at all costs be obeyed. It does not matter, apparently, if it implies stealing someone else's husband or someone else's fiancée; it does not matter that every single consideration of suitability would be against its satisfaction. If the impulse is once felt, it must be satisfied. And everyone, whether parent, guardian, husband or friend who would dare to put an obstacle in the way is regarded not merely as a spoilsport but as a positive enemy of the human race. As this is the kind of idea which is impressed upon the rising generation in most of the films they see, and as it is supported by the suggestions received from most novels and plays, it is small wonder that so many disasters occur. There is, in fact, going on at the present time an extensive propaganda, probably all the more insidious because it is not deliberate, against the whole traditional conception of the proper relation between the sexes.

We might carry the consideration further back still, and ask what state of mind it is that provides suitable soil for such seed. The answer is a mentality devoid of the wholesome salt of Christian doctrine. People of middle age can well remember the argument that used to be put forward, as if it were axiomatic, in the days of their youth: "If only we could rid ourselves of the Christian dogma which divides us, we could all support the Christian moral standard which should certainly unite us". During the interval we have seen Christian doctrine jettisoned by a large proportion of our people and we now find that they have jettisoned also the Christian standard of ethics. This result might well have been expected. In the long run conduct will conform with belief. If we no longer hold a Christian creed we have no effective power to uphold Christian conduct.

But there is a deeper reason still for the present malaise. Mental attitudes of all kinds run in fashions just as do tastes in dress or other æsthetic matters. The modern science of psychology, only half understood, has led the rising generation to fear "inhibitions" as their grandparents feared sin. To be completely uninhibited appears to be the goal of modern youths' desire. It would be easy to show what an absurdity it is to believe that anyone can live without restraints of some kind, but it will take a long time for reason to re-assert itself against the mass suggestion of public opinion. Modern youth is terribly handicapped by its conceptual environment. The thing one must not do in these days is to pass a moral judgment. Everything must be objective, factual, scientific. What are known as the normative sciences are not reckoned as science at all. Poems, plays, novels, histories may be searched from end to end without ever finding a judgment on any moral problem. No doubt this is in large part a reaction against something believed to be "Victorian", and it expresses the modern determination to live a life of one's own, free from all outside restraint.

Certainly we must have freedom somewhere, and a generation that has suffered two world wars, and has entered into a social revolution by which

it is subjected to controls of every kind, asserts the last relic of its pride in this claim to moral irresponsibility. It is an extraordinary paradox, reminiscent of Kipling's demented lighthouse keeper who became so obsessed by the sight of the ships passing always in the same confined channel that he removed the buoys marking their course. He got a break in the monotony of his existence, but he made universal shipwreck. It is possible that we shall see a good deal more wreckage of personal lives and social standards before a new generation becomes alive to its error and restores the old and well-tried guiding signs.

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THE RÔLE OF MARRIAGE GUIDANCE

By DAVID R. MACE, M.A., B.Sc., Ph.D.

General Secretary, Marriage Guidance Council.

THE work of the Marriage Guidance Council figures prominently in the recently published Final Report of the Denning Committee on Divorce, or, to give it its proper name, the Committee on Procedure in Matrimonial Causes (H.M. Stationery Office, price 9d.). If, as seems highly probable, this Report is implemented, we may soon see a widespread expansion of marriage guidance facilities throughout the country. Since difficulties in sex adjustment frequently come to light in the investigation of marital disharmony, it is appropriate and timely that some account of the rôle of marriage guidance should appear in this issue. I shall endeavour first to indicate briefly how a nation-wide marriage guidance service would operate, and then to discuss its relation to the diagnosis and treatment of sexual disorder.

From its inauguration in 1938, the Marriage Guidance Council has enjoyed the closest cooperation of members of the medical profession. As one of its non-medical members, I welcome this opportunity to pay tribute to the devoted service given to the Council by an ever-increasing number of medical men and women who are anxious to share in the task of making marriage and family life stable and secure. It has, however, always been clearly recognized that marriage guidance could not be regarded as exclusively or even primarily a medical service. It is a social service which has important medical aspects, and it is as such that the Denning Committee has rightly defined it. The marriage relationship covers the whole field in which human personality expresses itself—physical, emotional, intellectual, social, moral and spiritual—and we must beware of making an undue emphasis at any one point. For this reason, we do not use the word “clinic” to describe the place where our work is localized. We prefer the word “centre”. A clinic is generally understood to imply a service which is narrowly medical or psychological. An adequate marriage guidance service could not be provided on this limited basis. Moreover, a clinic implies treatment: in its technical sense that is, and ought to be, the province of the qualified medical practitioner, and of those who work under his direction. The last thing we wish to do is to take the practitioner’s work from him. On the contrary, our aim is to put into his skilled hands those who *need* his help but are not aware of their need until we point it out to them. Our purpose, in short, is to refer people to the medical and psychological services already in being, and to press for the extension of such services when we find them to be inadequate.

PLAN OF PROCEDURE

How then does the marriage guidance centre work? It offers help to all who

need it, either in terms of preparation before marriage, or of counsel in marital troubles of every kind. Those who deal with applicants to the centre must in the first place be prepared for anything, and must therefore have a wide general knowledge of marriage, of the many points at which it may go wrong, and of the appropriate remedies which can be applied. One case may resolve itself into a question of economics, another may fall into the sphere of ethics, a third may be physiological, a fourth legal; whilst a fifth may involve all of these factors and others besides. It is therefore clear that no single individual could possibly possess the competence to deal fully with every type of marriage trouble. Either he will have a wide but inevitably superficial knowledge of the whole field, or he will have a detailed knowledge of one section of it and a mere passing acquaintance with the rest.

The marriage counsellor.—Experience has taught us that in these circumstances the best policy is to provide the marriage guidance centre with helpers of both kinds. Those with general all-round knowledge are called marriage counsellors. They take on all comers so far as the first contact is concerned. They proceed to deal with simple difficulties based on ignorance or misunderstanding. But it is essential that they should be able to recognize the symptoms of deeper disorders which they ought to pass on. For that reason we affirm with the greatest possible emphasis that sympathy and “common sense” are not enough. The marriage counsellor, in addition to being carefully selected as to personal qualities, must receive some training in the basic principles of marriage guidance. A course of forty-eight lectures is now being given, on an experimental basis, to the first group of potential marriage counsellors in London. This will be developed and extended as experience dictates. It is hoped thus, in the next few years, to build up throughout the country a body of men and women who conform to an agreed standard of competence in dealing with marital problems. At present most marriage counsellors are people of professional status who are serving on a part-time and voluntary basis. But the future may see marriage counselling established as a full-time form of social service.

The marriage consultant.—Those who serve the centre in a specialized capacity are the marriage consultants. We have found that, to offer a full service, it is necessary to have consultants in five categories:—(1) medical; (2) psychological; (3) ethical and spiritual; (4) social, and (5) legal. There are obvious subdivisions of these categories—various specialized medical fields, spiritual advisers belonging to different religious groups, and so forth. Each centre will naturally build up its own panel of consultants, according to its needs and the available resources.

Here we are concerned only with marriage consultants in the fields of medicine and psychiatry. A working basis has been arrived at mutually by the Marriage Guidance Council and the British Medical Association, to define the relationship between the medical practitioner and the marriage guidance centre. In effect this requires any individual medical helper to decide whether he will work as a marriage counsellor or as a consultant.

He ought not to be both, because in theory he might then be able to refer patients from the centre to himself, and thereby gain professional advantage. In point of fact, it is not desirable that he should act as a marriage counsellor at all if he is in practice in the area which the centre serves. This means that medical practitioners who do counselling work are in general married women who have given up private practice, or men and women who have retired from active medical work.

It is hoped in the future to build up a list of medical practitioners who are specialists in marriage guidance, and who as such will be used as consultants to the centres. The means by which this will be done, and the necessary safeguards against possible breaches of professional etiquette, have been agreed upon with the British Medical Association. It is generally recognized that all practitioners would not wish to deal with the delicate issues which the marriage consultant must face, and that it is better for those who have the inclination and equipment necessary to specialize in this work. Yet it is hoped that all members of the medical profession will recognize the value and importance of an efficient marriage guidance service, and will give it the support and help it needs.

It would not be within my province to give any detailed account of the aspects of marriage guidance which fall within the field of medicine, and still less to suggest how they should be dealt with. Those who are interested will find a full account in an article by Edward F. Griffith in the *Lancet* of February 1, 1947, under the title "Medical Aspects of Marriage Guidance".

THE RÔLE OF THE MEDICAL PRACTITIONER

There are many general ways in which the medical practitioner can help to establish sound marriages. Often husbands and wives drift into conflict because one is in poor general health and unable to cope with life's daily demands. Sometimes conditions in the home are unhygienic. In some cases physical or mental disturbance in children will put severe strain upon the parents. The trouble may be that a child is desired and does not come, or that more children come than are desired. These and many other factors disruptive of marital harmony are naturally brought to the family doctor in his rôle of friend, philosopher and guide.

It is in the treatment of sexual disorder, however, that the practitioner makes his particular and unique contribution to marriage guidance. Our experience leaves us in no doubt as to the vast amount of sexual disharmony which exists in modern marriage, nor concerning its far-reaching consequences in personal unhappiness and social upheaval. Some degree of sexual maladjustment is found to exist in almost every marriage breakdown, either as the root cause of the marital conflict or as a symptom of it.

This latter distinction is important. Many married couples never attain the mutual orgasm which is the desirable end in good sex adjustment. The frustrations which result may thrust up into the personal fellowship of the marriage, making the couple tense and irritable and causing quarrels

which lead to the gradual deterioration of their mutual comradeship. But the opposite may also occur. A couple may, after reaching good adjustment, find that their sex life is thrown out of gear because at the personal level their affection and respect for each other have been undermined. As one wife put it, the sex relationship failed to function "because there was nothing left for it to express". In the first case, help in the specifically sexual sphere will restore harmony to the marriage. In the second, no attempt to improve sexual technique will of itself avail, because the real trouble does not lie at that point. Yet the restoration of the personal relationship may automatically revive the capacity for mutual sexual response.

Cooperation with the marriage guidance centre.—It is therefore necessary to recognize that sexual disorders cover a wider field than that which is the exclusive province of medicine. There has been a tendency in some quarters to regard sex as a narrowly physiological function, capable always of being dealt with by galvanizing certain nerves or muscles into action. The doctor who confines himself to this approach will only do a disservice to his patients. The inescapable fact is that the physical organs of sex may not operate at all unless the right emotional conditions are present. Thus an impotent husband will often come to us after half a dozen different doctors have examined him and assured him that "there is nothing physically wrong". Yet he remains impotent. Or a frigid wife will pass the closest scrutiny of the gynæcologist and even of the endocrinologist, but still fail to be sexually aroused by her husband. Here is where the cooperation between the medical practitioner and the marriage guidance centre can be particularly fruitful. The good marriage counsellor will cooperate with the doctor by seeking to improve the general quality of the relationship between husband and wife, thus making the more specific task of removing the sexual disorder much more likely to achieve success. The doctor cannot be expected to sit down for hours with husband and wife and go into all the complex details of their life together. Yet if he limits himself to the narrow field of their sexual maladjustment he may fail because he is working in an atmosphere hostile to the achievement of his purpose. We have seen this happen in our work. At the centre, we have sometimes been able to clear up a sexual disorder which the doctor had failed to treat successfully, for the simple reason that he was unable to deal with the trouble in the setting of the marriage relationship as a whole. So long as the medical practitioner remains as busily employed as he is at present, there seems little likelihood that he will be able to devote the amount of time which is necessary to deal adequately with marital disharmony, unless he decides to specialize in this work. But with the marriage guidance centre to help him, he can give what time he has to the specific and exclusively medical factors in sexual disorder (and there are many such) which he, and he alone, is competent to handle.

THE NEED FOR SPECIAL TRAINING

Two difficulties arise at this point. The first is not in my view as real as is

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EDUCATION OF THE GENERAL PUBLIC

The ignorance of a few doctors, however, is as nothing compared with the appalling ignorance of the general public regarding sexual matters. Our experience only too plainly reveals that the so-called modern "enlightenment" about sex does not go very deep. Where there is knowledge it is frequently patchy and uncoordinated, and set in the mould of an unwholesome emotional attitude to sex. For this reason, the Marriage Guidance Council increasingly takes the view that the effective long-term answer to our present sexual and marital disorders lies in a great educational campaign to inculcate accurate knowledge in a healthy emotional atmosphere.

At this point the medical practitioner can render valuable service. He may, if he is accustomed to public speaking, spare time occasionally to take part in lecture courses designed to spread enlightenment. He can also, in the course of his general practice, advise parents about the sex education of their children, guide adolescents through their first stormy encounters with awakening sex impulses, and prepare young adults for marriage. Even if he has not the time to talk at length to his patients about right attitudes to sex, he may often be able to help them by putting the right books into their hands.

Literature.—In this connexion also, the Marriage Guidance Council can help. We soon began to realize that members of the public were at a loss to know where to secure sound literature about sex and marriage. People often feel embarrassment about asking for books on sex. Even when they can overcome this, they have no clear ideas whether the books they see advertised or for sale are the ones best suited to their needs. Young people in their quest for knowledge often buy and devour wholly unsuitable literature, which may do them emotional harm. To help such people, we have now established our own Marriage Guidance Book-Room at our London Headquarters at 78, Duke Street, London, W.1. We have prepared a carefully selected list of books and booklets which we can unhesitatingly recommend, with explanatory notes to indicate in each case the scope and emphasis of the work in question. We are always ready to advise about other literature in the field of marriage guidance. This is part of our service, and a copy of our book list will gladly be sent on request. In particular, we are producing a series of booklets of our own, designed to meet the needs of people as these needs appear in our actual work. The first three deal specifically with sexual matters: "Sex in Marriage" aims at giving a straightforward, positive account, in simple language, of the part which sexual union should play in the normal marriage; the other two booklets deal respectively with "Sex Difficulties in the Husband" and "Sex Difficulties in the Wife". All are the joint productions of the officers and committee of the Marriage Guidance Council, and every effort has been made to have them checked by experts in the field. They cost sixpence each, a price which makes them easily available to all who need the help which they offer.

sometimes supposed. It is the possible danger that, if non-medical marriage counsellors are allowed to deal with sexual disorders, they may presume that they have more competence than they actually possess, and so exceed their powers. In point of fact, our experience suggests that almost the opposite is the truth. The self-styled "know-all" about sexual matters almost invariably proves to be the person who knows very little. It is a little knowledge that is dangerous. The increase of knowledge tends always to inculcate a deeper respect for the person whose knowledge is more complete. Thus if we can train the marriage counsellor to the point at which he fully comprehends the line of demarcation which defines his own limitations, we need have little fear that he will act so unwisely as to cross that line. This is in fact what we have found in our work. The good counsellor knows exactly when he has laid bare something which must be passed on to the medical practitioner, and does so without delay.

The second difficulty lies with the medical practitioner himself. Here I speak with some diffidence. Yet it is my very regard for the medical profession which prompts me to plead for better training of the practitioner in this important field of medicine. People tend naturally to turn to the doctor for help about sexual matters. They repose great confidence in his judgments. Yet often he has never had the training necessary to enable him to handle with confidence these delicate problems which are brought to him. Many of my medical friends have acknowledged that they went into practice very inadequately equipped for this side of their work, and had to read it up in their spare time afterwards. No doubt the curriculum of the medical student is heavily overloaded, and the addition of fresh subjects difficult in the extreme. Nevertheless, in these days, when there is so much sexual disorder, or at least so much greater readiness to seek advice about sexual disorder, it is unfair both to the doctor and to his patient that the former should not be sure of his ground. I have known medical men who frankly confessed that they were unable to deal with sex difficulties which were brought to them. While such honesty may be virtuous, it is highly unsatisfactory that any doctor should be placed in such an embarrassing position. The chief difficulty, no doubt, will lie in the fact that medical students are comparatively young, in the main unmarried, and sometimes themselves passing through a time of emotional difficulty. This would not matter so far as giving them instruction in the technique of the pre-marital consultation is concerned, and as the demand for such consultations will without question greatly increase in the future, it is probably advisable that this matter should be dealt with in the curriculum. But it may well be best to postpone any detailed instruction in the giving of help in cases of marital disharmony until the postgraduate stage, when perhaps it could be included in courses devoted to other matters which are best deferred until this later stage in training. These are technical questions to which the medical schools could surely find the appropriate answers.

THE PROBLEM OF STERILITY: ITS INVESTIGATION AND TREATMENT

By MARGARET MOORE WHITE, M.D., F.R.C.S., M.R.C.O.G.

Chief Assistant, Fertility Department, Royal Free Hospital; Consultant Gynaecologist, Emergency Medical Service.

THE problem of sterility is one of importance since ten to twelve per cent. of married couples are childless and, of this number, the majority are involuntarily so. This figure does not include those couples who have not succeeded in having a family of the size they desire. Two persons are concerned in a fertile mating and an average of four to five factors militate against conception in every infertile couple. In most cases some measure of responsibility rests on both sides and, from the methods of investigation at present available, it would appear that the male is equally as responsible as the female.

ROUTINE EXAMINATION

It is therefore evident that if it is desired to raise the standard of fertility both parties must be thoroughly investigated and treated. Any factor that lowers the state of health of the individual may lessen fertility. Excessive fatigue, a deficient diet, infection or intoxication, or over-indulgence in sex, may adversely affect spermatogenesis, and it is reasonable to assume that many of these factors adversely affect oögenesis. Inquiry should therefore be made regarding habits of life and search made to eliminate any possible source of intoxication and infection. Contrary to what might be expected, syphilis only rarely affects spermatogenesis and gonorrhœa never, except temporarily, as might any severe infection. The latter disease, however, can cause occlusion of the sperm-conducting passages, but since the introduction of the sulphonamides and penicillin the incidence of involvement is reduced to a rarity. The same applies in the case of the female, and in a series of 928 cases (Moore White, 1945) gonorrhœa was responsible for tubal occlusion in only 1 per cent. of women, and this before the introduction of penicillin.

Inquiry should be made regarding the normality of sex relations, and examination must exclude the existence of such physical causes for failure of impregnation as hypospadias, phimosis, undescended testicles in the male, and an intact hymen, a cervical polyp, genital hypoplasia in the female. Retroversion of the uterus is seldom a cause but may be a symptom of sterility. As is evident from tubal insufflation and salpingography the retroverted position of the uterus only rarely prevents the passage of the medium. It is possible that the often associated prolapsed position of the ovaries may adversely affect the entry of the ovum into the Fallopian tube.

Examination should exclude the existence of stigmata of endocrine

OTHER ORGANIZATIONS

In pursuance of our general policy that our object is to supplement and not to usurp the work of others, we do not as a Council undertake sex education in the wider sense. Our educational work is confined to general and specific preparation for marriage, beginning with young people about the age of sixteen. There are, however, several organizations which are doing excellent service in the general field of sex education. The three principal ones are The Alliance of Honour, 112, City Road, London, E.C.1; The Central Council for Health Education, Tavistock House, Tavistock Square, London, W.C.1; and the Church of England Moral Welfare Council, Room 251, Church House, Dean's Yard, Westminster, London, S.W.1. Each of these organizations produces literature and arranges lecture courses. The Central Council for Health Education also offers films for use in sex education courses.

In the field of marriage guidance we were until quite recently the only organization at work. However, we had always felt some diffidence about dealing with Roman Catholics who sought our assistance, particularly because we knew of their strict attitude towards scientific contraception. It is one of our basic principles that we must, in dealing with marriage troubles, respect the religious convictions of those concerned. To give people advice which goes counter to their religion might well extricate them from one conflict only to plunge them deeper into another. Therefore after some negotiation our Catholic friends judged it best to form their own entirely separate organization. Under the title of the Catholic Marriage Advisory Council (38/39, Parliament Street, London, S.W.1) they have set up a marriage guidance service designed exclusively to meet the needs of the Roman Catholic community, and operating upon the same general basis as our service to the non-Catholic community.

CONCLUSION

The removal of sexual ignorance, and the building up in its place of a sound, healthy attitude to the sexual function, will do much to prepare the way for the right use of sex in sound marriage and parenthood. The need for this, in these days of the disintegrating marriage and the broken home, is too obvious to require emphasis. The marriage guidance movement, together with kindred agencies, is seeking to provide the answer. Although marriage guidance covers a wider field than that of medicine, it depends to a considerable extent, if it is to achieve its purpose, upon the whole-hearted cooperation of medical practitioners who can bring to the treatment of sexual disorders the highest possible degree of wisdom, understanding and skill. We have never lacked the medical help we have needed in the past, and we look forward with confidence to its continuance and expansion in the future.

THE PROBLEM OF STERILITY: ITS INVESTIGATION AND TREATMENT

By MARGARET MOORE WHITE, M.D., F.R.C.S., M.R.C.O.G.
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THE problem of sterility is one of importance since ten to twelve per cent. of married couples are childless and, of this number, the majority are involuntarily so. This figure does not include those couples who have not succeeded in having a family of the size they desire. Two persons are concerned in a fertile mating and an average of four to five factors militate against conception in every unfertile couple. In most cases some measure of responsibility rests on both sides and, from the methods of investigation at present available, it would appear that the male is equally as responsible as the female.

ROUTINE EXAMINATION

It is therefore evident that if it is desired to raise the standard of fertility both parties must be thoroughly investigated and treated. Any factor that lowers the state of health of the individual may lessen fertility. Excessive fatigue, a deficient diet, infection or intoxication, or over-indulgence in sex, may adversely affect spermatogenesis, and it is reasonable to assume that many of these factors adversely affect oögenesis. Inquiry should therefore be made regarding habits of life and search made to eliminate any possible source of intoxication and infection. Contrary to what might be expected, syphilis only rarely affects spermatogenesis and gonorrhœa never, except temporarily, as might any severe infection. The latter disease, however, can cause occlusion of the sperm-conducting passages, but since the introduction of the sulphonamides and penicillin the incidence of involvement is reduced to a rarity. The same applies in the case of the female, and in a series of 928 cases (Moore White, 1945) gonorrhœa was responsible for tubal occlusion in only 1 per cent. of women, and this before the introduction of penicillin.

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disorders. Rowe (1929), in a study of 4,000 cases for endocrine status, found that "nearly half of the ovarian cases were unproductive, about one-third of both the pituitary and the thyroid, and only one-quarter of the non-endocrinal".

INVESTIGATIONS IN THE MALE

Following routine examination a series of investigations require to be undertaken. A high standard of work is essential. The relative importance of the male factor in a subfertile marriage can only be properly assessed by a complete semen analysis.

Semen analysis.—A diagnosis of anæmia is not made by the practitioner in his consulting room on examination of a drop of blood under the microscope; use is made of a hæmocytometer and the examination is made by a skilled pathologist. Yet there are still many who think that an opinion on male fecundity can be given by visual examination of a drop of semen under the microscope. Seminology is a science, and it requires skill and experience to give an accurate report on a specimen of semen. Detailed investigation of semen has made it evident that subfecundity in the male plays a more important rôle than was previously thought. A standard method of examination has been suggested (Harvey and Jackson, 1945). They have compiled a table in which they quote the minimum "A" values for the four factors used in assessing male fecundity (table 1).

MINIMUM "A" VALUES FOR THE FOUR FACTORS USED IN ASSESSING MALE FERTILITY

TABLE 1

Density	50 million/c.cm.							
Morphology	65 per cent. normal							
Basic motility (percentage fully active after 1 hour at 37° C.)	Age at start of incubation (hr)							
	$\frac{1}{2}$	1	2	3	4	5	6	7
	50	45	35	27	21	17	13	10
	Age at start of incubation (hr)							
Viability ratio	$\frac{1}{2}$	$\frac{1}{2}$ -3		3-5		5-7		
	1.5	1.25		1.0		0.75		

It is not suggested that fertilization of an ovum cannot occur with semen that falls below standard, but if a man whose semen is below standard is mated with a highly fertile woman there is a much greater chance of success than if he is mated with a woman of low fertility. Hence the importance of bringing about even minor improvement in spermatogenesis. I can cite a case in which semen with marked oligozoö spermia (five million per c.cm.) and anizoö spermia (45 per cent.) proved fertile.

A high percentage of males are subfecund. In a series of 1,356 cases collected by three independent observers, 11.4 per cent. showed azoö sper-

mia, 16.5 per cent. marked oligozoö spermia (Jackson, Sharman, and Moore White, 1945). According to American writers the semen of 60 per cent. of men falls below an approved standard. Azoö spermia is occasionally a sequel to bilateral orchitis with mumps but is more often due to non-descent or late descent of the testicles: 18 per cent. of cases of complete azoö spermia (Riches and Millin, 1945). These writers are of the opinion that the testicles must be in the scrotum within two to three years of the beginning of spermatogenesis, which occurs at about nine years of age.

Subfecundity may be evident by an increase in the percentage of abnormal spermatozoa, especially abnormal head forms, and in diminished viability. This latter factor is of importance when it is borne in mind that the ovum does not survive longer than twenty-four hours. In the majority of cases there is no apparent predisposing cause for defective spermatogenesis. To this condition the term "congenital aplasia" has been applied. It has been suggested that hereditary deterioration of poor stock, dietary deficiencies of the mother during foetal development or of the adolescent male, or the unnatural concomitants of modern social conditions are the cause. The condition is more prevalent in those who do mental as opposed to physical work.

INVESTIGATION OF FEMALE FECUNDITY

The essential factors for reproduction in the female are:—(1) The occurrence of ovulation. (2) Patency of one or both Fallopian tubes. (3) Receptivity of the cervix to spermatozoa.

OVULATION.—Ovulation occurs in the majority of women at regular monthly intervals. An occasional anovulatory cycle occurs from time to time in normal women and is usual during the period of establishment and cessation of menstruation. Rubenstein (1937) first drew attention to the fact that the early morning rectal temperature in women who have not yet passed the menopause is biphasic in character. During the pre-ovulatory phase the temperature remains at a lower level than during the post-ovulatory phase. Tompkins (1945) has shown that the latter phase shows an almost invariable constant duration of fourteen days, whereas the pre-ovulatory phase may vary greatly in duration. The rise of temperature at the initiation of the second phase indicates that ovulation has occurred. Only rarely does comparison between the temperature record and the endometrial biopsy findings fail to correspond. As is evidenced by the temperature record, failure of ovulation is not necessarily associated with absence of menstruation. The most common cause of lack of ovulation is the condition of genital hypoplasia. This condition may be considered analagous to congenital aplasia in the male. The severest forms of genital hypoplasia are usually associated with amenorrhœa but the milder forms are not so easily recognized. Certain stigmata have been described by different observers and the findings of one or more of these may suggest the diagnosis of hypoplasia. The incidence of this condition as a cause of sterility varies

according to the observer: Green-Armytage (1945) considers that hypoplasia is a main factor in 30 to 35 per cent. of sterile women.

Genital hypoplasia may be suggested if there is a history of delayed onset of menstruation, scanty or infrequent menses, severe functional dysmenorrhœa, and sexual frigidity. It is not unusual to find on physical examination that the vagina narrows at the upper end, the cervix is hard, long and conical or short and button-like, the fornices are shallow and there is no "give" to the vaginal vault, thus rendering a pelvic examination difficult. The uterus is hard, non-pliable, is markedly ante- or retro-verted, and the cervico-uterine angle cannot be decreased on manipulation. Passage of a uterine sound reveals a disturbance of the usual ratio of cervix to fundus of one to three. The ovaries are insensate to bimanual examination. They contain unfertilizable or immature ova. The cause of genital hypoplasia is unknown. It can only be assumed that some stimulus to normal development is lacking. Some of these cases respond to endocrine treatment if taken in early adult life, and some show complete development as the result of marriage if this is not delayed. It is of importance to detect such cases, for much time and money are spent on futile treatment of sterility in undiagnosed cases of hypoplasia. Should a condition of uterine hypoplasia have been established for a number of years, endocrine treatment, on the basis of the present state of knowledge, will not provide the necessary stimulus to development.

The endometrial biopsy.—Microscopical examination of an endometrial biopsy taken during the week preceding menstruation will indicate whether ovulation has taken place or not. The appearance of the stroma and glands during the luteal phase is characteristic (Rock, 1940). The test can be performed easily in the clinic. Using aseptic precautions, a special narrow type of curette is passed to the fundus of the uterus; as it is withdrawn, the cutting edge scrapes off a minute fragment of endometrium, which is placed in formol-saline solution and sent for microscopical examination. At one time it was thought that the degree of progesterational change in the endometrium at a given time in the menstrual cycle was an indication of progesterone output. Since the appearance of material taken from different parts of the endometrium as well as in different parts of the same section can vary widely, the test is of less value than was formerly thought. The premenstrual estimation of pregnandiol in the urine (Venning and Browne, 1937) provides the best indication of luteal function.

In practically all cases the rectal temperature record provides correlating evidence of ovulation and, since it necessitates less discomfort to the patient, is the method of choice. Endometrial biopsy provides a useful adjunct in those cases in which the temperature record suggests an anovulatory cycle and when the temperature rise during the second phase of the cycle is slight. Biopsy may also prove helpful in suspected cases of tuberculous salpingitis. Sharman (1944) found associated tuberculous endometritis in 5.1 per cent. of cases investigated for sterility.

INVESTIGATION OF TUBAL PATENCY.—There are two methods of investigating tubal patency—the one by utero-tubal insufflation (Rubin, 1920), the other by the injection of a radio-opaque oil into the uterus and tubes. The former investigation can be done in the consulting room or clinic, the latter in the X-ray department; both without anæsthesia. This factor is of considerable importance when the present bed shortage in hospitals and nursing homes is taken into account. During the ten years in which I have conducted both procedures, only one hospital patient has been detained for the night, and on only one occasion has it been deemed necessary to send a private patient home by conveyance.

An insufflator with kymograph attached is recommended. This enables the exact pressure at which tubal patency is obtained to be ascertained and depicts fluctuations which represent the peristaltic movements of the Fallopian tubes.

Interpretation of insufflation results.—In the normal tube a pressure of 40, 60, 80 to 100 mm. Hg is required to overcome resistance at the isthmal end of the tube. At this point the recording needle drops slightly and fluctuations are recorded on the kymograph. It is not necessary to transmit more than 60 to 100 c.cm. of carbon dioxide to obtain an accurate reading. Abdominal auscultation permits the hearing of intermittent escape of gas coincident with tubal contractions. Following normal patency the patient experiences pain referred to the shoulder, especially if she rises immediately from the couch.

Stenosis of the Fallopian tubes is indicated by a rise of the recording needle to more than the usual pressure, a gradual fall or continuance in a straight line and absence of fluctuations. On auscultation a continuous bubbling sound is heard which indicates that the tube is acting as a conductor and has lost its power of contractility. Care must be taken not to mistake this bubbling sound for borborygmi in the intestines or to confuse it with the escape of gas from the cervix. It is extremely rare for pregnancy to occur when tubal stenosis exists. Should conception take place a tubal pregnancy is likely.

Occlusion is evidenced by a rise of the recording needle to the maximum pressure of 220 mm. Hg, at which point the gas requires to be turned off. It is not always possible to ascertain by insufflation whether both tubes are patent, nor is it always possible to know the site of obstruction, unless indicated by localization of pain. The existence of spasm at the utero-tubal junction may lead to an erroneous diagnosis of organic occlusion if reliance is placed on one test by one method only. The administration of a quick-acting antispasmodic, such as octyl nitrite, immediately before the performance of insufflation or a salpingogram, greatly lessens but does not obviate the possibility of spasm. Hence, it is always advisable to test on three occasions, one of them by an alternative method, before giving a final diagnosis of organic occlusion. Sharman (1944) records an incidence of spasm in 10 per cent. of cases, both on insufflation and radiography, and in six out of twenty-nine cases under anæsthesia.

Interpretation of skiagrams.—It is difficult to believe that there can be inaccuracy and discrepancy over the interpretation of salpingograms but such is the case and it appears that accuracy is only born of experience. Salpingography can be performed with or without screening. The main advantage in screening is that it is possible to observe whether sufficient oil is being injected to fill the Fallopian tubes and to ensure that failure of the radio-opaque substance is not the result of injection of too little material. An inaccurate interpretation may be made in cases in which an insufficient amount of oil has been injected. As a rule, 6 c.cm. suffices, but should the uterine cavity be enlarged or the tubes be unusually long, more is required. It is advisable in all cases to take a second film within a few hours or twenty-four hours after the first to ascertain whether peritoneal smearing with opaque oil has occurred. On more than one occasion, I have seen what appears to be a perfectly

normal immediate salpingogram, but, in the second film, absence of smearing and the radio-opaque material accumulated at the fimbriated ends of the tubes, indicating non-patency.

A stenosed tube is indicated by narrowing of the lumen, frequently along the whole course of the tube. Tuberculous disease is indicated by beading, irregular filling of the tube and sometimes by oleosalpinx (accumulation of oil in the end of the tube). When pelvic adhesions exist, traces of oil may still be seen at the same site in the tube in the second film.

Complications: Immediate.—Provided the recommended precautions are taken the risks are minimal, and gas or oil embolus should not occur. It is inadvisable to carry out either of the above-mentioned procedures immediately before or after menstruation or intercurrent vaginal bleeding. When insufflating, the pressure must not be raised above 220 mm. Hg, nor, when performing uterosalpingography, must the injection be given too quickly. Using the more fluid opaque oil preparations introduced in recent years, venous intravasation occasionally occurs, but the likelihood of complications as a consequence is very small.

Complications: Late.—If aseptic precautions are taken the chances of introducing infection are slight. There is, however, always a possibility that a pre-existing infection may become stirred up. The risk is slightly greater when oil is introduced, since particles of infected material latent in the tubes are more likely to be propelled out into the peritoneum than they are by the passage of gas. An exacerbation of infection may take place in an already sealed tube, resulting in a pyosalpinx.

RECEPTIVITY OF THE CERVIX.—For some years it has been known that the cervix, like the uterine endometrium, undergoes cyclical changes. Examination of material aspirated from the cervical canal in a fecund woman shows a typical appearance at the different phases of the menstrual cycle. During the ovulatory phase, cervical secretion increases in amount and if the cervix is viewed through a speculum a cascade of mucus can be seen hanging from the os.

The post-coital cervical test.—Examination of secretion obtained from the cervical canal was first described by Huhner (1921).

The fluid can be aspirated by means of a syringe with a long cannula. During the ovulatory phase it is a transparent viscid fluid, alkaline in reaction and, if viewed microscopically, contains little but a few cervical epithelial cells and an occasional leucocyte. If microscopical examination is made within a few hours of coitus, masses of motile spermatozoa will be seen to have penetrated the mucus. Motile spermatozoa have been found in the cervical mucus in exceptional cases a week and even longer after intercourse. In the normal case motile spermatozoa should be present a few hours after coitus.

Failure to find spermatozoa in clear mucus suggests either faults in delivery of the sperm or absence, weakness or lowered viability of the spermatozoa. When the cervical plug is scanty, muco-purulent or acid in reaction, spermatozoa are repelled and few, if any, are found. Cervical mucus examined during the post-ovulatory phase is opaque, becomes if anything more viscous and microscopically contains degenerate epithelial cells, the fragmented nuclei of which are apt to be mistaken by the untrained observer for polymorphonuclear cells and may cause the erroneous diagnosis of endocervicitis.

The incompatibility of cervical mucus and spermatozoa can be demonstrated by the invasion test (Kurzrok and Miller, 1928; Barton and Weisner, 1945).

A drop of cervical mucus obtained during the ovulatory phase is placed on a slide and a vaseline-ringed coverslip applied. A drop of the husband's semen is placed on the slide adjoining a gap in the vaseline ring. The point of meeting of the two liquids is called the interface. The rate of penetration of the mucus on the opposite side of the interface provides an index of the conditions that hold good in the particular case in the cervix. When no spermatozoa are found the material can be tested against sperm of known viability. Artificial insemination from husband to wife is useless if the invasion test is negative.

TREATMENT OF STERILITY

It will be evident from the description of the investigations necessary in a case of impaired fertility that they require to be conducted by those who have made a special study of the subject and are in a position to correlate the results. Both husband and wife should be investigated simultaneously. Care should be taken to ensure that one party does not embark on some expensive treatment until it is known whether any absolute contraindication is present in the other. The object of treatment is to remove as many infertility factors as possible. In some unfertile marriages the level of fertility falls only just below that necessary for conception and some simple treatment may suffice; in others long and tedious treatment may be necessary before a sufficient number of inhibitory factors have been removed to render conception likely.

General health and advice.—The state of health of both man and wife should be improved by attention to any condition that may lessen well-being. Sometimes a holiday in the country with good food and outdoor exercise will effect wonders. Attention should be paid to the diet and a strychnine tonic advocated if the appetite is poor. All foci of infection must be eradicated. It should be ascertained that there are no sexual difficulties. The couple must be instructed regarding the fertile phase in the menstrual cycle and the frequency of intercourse. The fertile phase in a twenty-eight day cycle lies between the tenth and the sixteenth day and intercourse can be planned to take place every second or third day during this period. Restriction of intercourse to the exact time of ovulation as denoted by the rectal temperature record becomes especially valuable when the spermatozoa are of low viability.

Endocrine treatment of the male.—A certain level of thyroid function is essential to testicular efficiency, and even those patients who fail to show evidence of subthyroidism may derive benefit from thyroid medication in small doses. The conditions of azoöspemia and extreme oligozoöspemia do not respond sufficiently to endocrine or other therapy to justify treatment. Diagnosis must not be based on a single semen analysis. Testicular biopsy can be performed in cases with azoöspemia to ascertain the state of testicular function. When the condition is due to a blockage of the vas deferens and testicular function is found to be good, a plastic reconstruction operation may be undertaken. In a few cases the operation has been successful and enabled ejaculation of sperm-containing semen to take place, with resultant impregnation.

Although much has been written against endocrine treatment of the male, I am convinced from comparison of detailed semen analyses undertaken by the same investigator both before and after treatment that hormonal therapy may prove beneficial. Improvement will be noticed in many cases of testicular deficiency following daily small doses of methyl testosterone taken sublingually for a month. A semen analysis is made before repeating the course. Many cases of diminished libido and partial impotence improve on the above treatment. The obese male of the "pituitary" type will often respond better to a course of gonadotrophic hormone.

TREATMENT OF THE FEMALE

As in the male, treatment must first be directed towards the removal of adverse constitutional factors.

To ensure ovulation.—A woman who is not menstruating, rarely ovulates, so that treatment of amenorrhœa may be required. The treatment of hypoplasia cannot be satisfactory until the cause is discovered. At present efforts must be directed to see that the physique of the adolescent girl is as good as possible, and that menstruation is established at the usual age. Social conditions should be advocated which favour early marriage to enable child-bearing to take place during the most fertile period of a woman's life, i.e., between the ages of twenty and twenty-five.

It is regrettable that ready means of assay of hormones in the human body are not available, hence endocrine treatment is given indiscriminately and often without success. Treatment that benefits one woman may have no effect on another. In women who are not ovulating a course of mixed gonadotrophic hormones may incite regular ovulation. In women who fail to ovulate regularly the injection of follicle-stimulating gonadotrophic hormone at the mid-menstrual phase may stimulate ovulation. Such treatment has occasionally proved effective in producing conception even when ovulation is occurring regularly. Irradiation of the pituitary gland with X-rays sometimes succeeds when the above treatment fails.

Tubal occlusion.—Repeated insufflation may restore tubal patency. Better results are often obtained following a course of pelvic short-wave therapy and œstrogens, the latter given during the follicular phase of the menstrual cycle. Given during the luteal phase it may delay the onset of menstruation and needlessly raise false hopes of conception. Isthmal occlusion of the tubes from organic cause rarely repays treatment in any form. The results of re-implantation of the tubes is extremely poor. Salpingostomy proves disappointing in the majority of cases: in very few in which the state of the tubes renders it possible to restore patency does pregnancy follow. The best results are obtained from salpingostomy performed for terminal occlusion of extrinsic cause.

CERVICAL RECEPTIVITY

Elimination of vaginal discharge.—Vaginal discharge may originate in the vagina from infection by trichomonas or monilia and may prove fatal to the spermatozoa. The appropriate treatment should be given.

Treatment of cervical infection.—An unhealthy cervix gives rise to a mucopurulent discharge, with a tenacious cervical plug through which the spermatozoa cannot penetrate. Infection by the gonococcus must be excluded. Many cervical infections respond to a course of systemic sulphonamides, 1 gm. three times a day, given for seven to ten days. The effect is more pronounced if combined with the administration of 1 mgm. stilbæstrol daily, given during the first ten days of the menstrual cycle. Limited cauterization and cervical repair may be necessary. Douching with Ringer's solution occasionally appears to assist conception: possibly when the phallus is short and fails to contact the cervix, or when the woman produces a scant amount of cervical secretion, it may act by neutralizing the acid vaginal contents sufficiently to prolong life of the spermatozoa.

Correction of uterine displacements.—Few cases of retroversion justify operative correction in the nulliparous woman. Benefit may accrue in the rare instances in which a retroversion causes such forward displacement of the cervical os that spermatozoa fail to enter, as evidenced by comparison of a post-coital vaginal and cervical test taken soon after intercourse. Operation may also be indicated in those cases in which, on insufflation or performing a salpingogram, the injected medium can only be introduced after correction of the malposition. Care must be taken to exclude operating on patients in whom the malposition is a stigma of hypoplasia.

Other gynaecological procedures.—Pregnancy sometimes follows myomectomy, although the fibromyomas have not caused tubal occlusion.

Why is it that success often appears to follow the simple procedure of dilatation of the cervix? It may be by disposing of a tenacious mucoid plug which has occluded the cervical os. It may be due to some reflex stimulation to ovarian function. Many have found that the passage of the biopsy curette or aspiration of cervical secretion has the same effect.

Other endocrine treatment.—In certain cases small doses of œstrogens given during the follicular phase of the cycle and luteal hormone (the synthetic preparations orally and the organic parenterally) during the gestational phase of the cycle assist conception. As in treatment of the male, small doses of thyroid gland given over a long period assist the functions of the reproductive glands. Treatment is especially applicable when menstrual irregularities exist.

Not infrequently obese women have difficulty in achieving pregnancy. I have found that better results follow efforts directed towards reducing the patient's weight by dietary and suitable medication before resorting to the administration of glandular products, with the exception possibly of thyroid gland. It is wise to leave the administration of hormones to those who have made a study of the subject, since the indiscriminate and ignorant use may induce menstrual irregularities.

CONCLUSION

In only approximately one-third of the married couples treated for subfertility does the woman conceive. Considering the extent of the investiga-

tions and the effort expended on treatment this is a poor result, and 7 to 8 per cent. of married couples still remain childless. Since there are no comparable statistics from earlier times, it is not possible to ascertain whether the fertility of the nation is declining. Statistics show that approximately 30 per cent. of males of sterile couples are subfecund; in 50 per cent. of these the cause is given as "congenital aplasia" of the testicles. Approximately 30 per cent. of sterile women possess occluded or partially occluded Fallopian tubes, and in only a small percentage can a definite cause be elicited. According to statements by different authors the percentage of sterile women suffering from hypoplasia of their reproductive organs varies between 10 and 30 per cent. Therefore it would appear that before any great improvement can result in overcoming the problem of sterility it is essential to discover the cause of congenital under-development of the reproductive organs and occlusion of the Fallopian tubes.

I am in agreement with Sharman (1944) that the majority of women with tubal occlusion, in whom no history of a provoking cause can be obtained, suffer from subclinical tuberculosis. In a very small number of cases radiography reveals evidence of pulmonary infection. In the majority of patients upon whom I have operated with a view to plastic reconstruction of occluded Fallopian tubes, tuberculous infection has been discovered microscopically. To prove or disprove this suggestion a comparison might well be made with a series of cases of sterility in the towns and cities of Canada where pasteurization of milk has been enforced for many years.

As regards congenital under-development, much might be learned by a study of persons of primitive races. That such a condition does exist is evidenced by work done on mating in rhesus monkeys. Very few sterile animals were encountered, and these were found among the socially uncooperative or those with infantile reproductive organs. Is subfertility the price to be paid for civilization with all its accompanying artificial conditions of life?

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THE CAUSATION AND TREATMENT OF IMPOTENCE

By KENNETH WALKER, F.R.C.S.

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IMPOTENCE, or inability to perform the sexual act, may be partial or complete, temporary or permanent. It may also be relative, that is to say, the patient may be unable to have sexual relations with one woman, generally his wife, and yet have no difficulty in cohabiting with another woman. Therefore in dealing with impotence we are dealing with a great variety of conditions.

I know of no entirely satisfactory method of classifying cases of impotence. Even the initial broad classification into psychogenic, or primary, and organic, or secondary, is not quite exact. If enough were known about the relationship of body and mind it would probably be found that organic factors often play a part in the genesis of what are regarded as being psychological troubles. So also do organic lesions of the genital organs almost always have psychological repercussions. In spite of this the usual division of impotence into organic and psychogenic provides a useful starting point. Another method is to classify cases of impotence in accordance with that constituent of the sexual act which is chiefly disturbed; for example, those cases characterized by failure in erection and those distinguished by some disturbance of ejaculation. The second of these two usually takes the form of a premature emission; but what is a more common disability than a perusal of textbooks would suggest is an inability to obtain any emission. This particular type of impotence will be dealt with more fully later. If the above methods of classification are adopted it must be borne in mind that divisions are not always clearly defined. Difficulties starting with a tendency to premature ejaculation almost always end in a failure of erectile power.

An inability to perform the sexual act satisfactorily is extremely common amongst modern civilized men. Hamilton found that only 55 per cent. of the husbands he interviewed when interrogating a large number of married couples were satisfied with their sexual capacity. Most of these self-confessed, incompetent husbands belonged to what must be regarded as being the more cultured sections of American society. In my own practice I have also found that sexual difficulties are extremely common amongst such highly educated men as clergymen and schoolmasters. It would therefore seem that modern conditions of living and modern systems of education are not conducive to sexual efficiency. Sexuality is so intimately connected with other activities in man that any disturbance of this particular function is usually associated with disturbances in a much wider area. Failure on the

part of a man to find a right attitude to his sexuality is almost always associated with a failure to adapt himself successfully to life in general. I have rarely, if ever, met a man who could be said to be satisfactorily adjusted to his environment and his fellows and yet suffered from sexual incompetence.

ORGANIC IMPOTENCE

This may be due to lesions of the external genitalia, to endocrine deficiency, to lesions of the central nervous system, or to some such general disorder as diabetes. Impotence due to abnormalities of the external genital organs is very uncommon. It is surprising how well a patient manages to overcome such a handicap as penile curvature provided that this lesion has not occasioned psychological difficulties. Fortunately most men who are attacked by fibrous cavernositis have reached middle age, so that obstacles to coitus are of less importance to them than they would be to younger men. Such minor obstacles to intercourse as a tight foreskin causing pain are so easily remedied that they need not be discussed here.

The *endocrine dysfunctions* most likely to lead to impotence are hypogonadism, hypopituitarism, and hypothyroidism. The first of these yields readily to endocrine therapy. Even when the patient has lost all testicular tissue and is a true eunuch, his capacity to perform the sexual act will generally be restored if sufficient testosterone be given. The following case history is an example of this.

Captain A.C., aged twenty-eight, while a prisoner of war in Germany underwent an orchidectomy for a seminoma of the testis. The testicle on the opposite side had never descended and was apparently missing, for subsequent to the orchidectomy he began to develop signs of eunuchoidism. Amongst these was a complete disappearance of sexual desire. On returning to this country he was given 50 mgm. of testosterone twice weekly, supplemented occasionally by small doses of methyl testosterone by the mouth. Sexual desire returned and he resumed intercourse with his wife.

Among the *lesions of the central nervous system* that may be responsible for impotence are tabes, general paralysis of the insane, spina bifida, concussion, and peripheral neuritis. The impotence of tabes is often preceded by a period of heightened sexuality due to irritation of the lumbar centres. The impotence produced by concussion, either cerebral or spinal, is likely to be only temporary.

Impotence may result from any severe disturbance of the general health. It is a frequent symptom of diabetes and is a common feature of neurasthenia, alcoholism and addiction to drugs. Sexual desire is also likely to be diminished in any case of auto-intoxication from chronic infection.

PSYCHOLOGICAL IMPOTENCE

No concise and well-tabulated account can be given of the different types of psychological impotence found in practice. Psychology has been termed a "superstructure", that is to say, it is a system of knowledge which rests on

unknown foundations. Psychotherapy must therefore be regarded as being an art based on empiricism and not as a science resting on a number of accepted fundamental principles. All that can be attempted is to discuss some of the more common psychological factors responsible for a psychogenic impotence.

Sometimes failure to perform the sexual act is merely the fruit of ignorance, as in the case of a middle-aged solicitor who once consulted me because, after two years of married life, "nothing had happened". Elementary instruction was all that was necessary to bring about a cure. But ignorance of the physiology of reproduction is often more heavily penalized. Failure to penetrate leads to attention being directed on to the penis with, as a result, weakening of the erection. This in turn engenders the fear that something is seriously wrong, confidence disappears and the patient becomes completely impotent. This is the sequence of events which is often responsible for the condition known as "first-night impotence". Not infrequently the confidence of the bridegroom was weakened prior to marriage. He believed that his genitalia were smaller than those of his fellows, or he recalled with a feeling of guilt that he had masturbated, and consequently he approached his marriage with anxiety. Should the slightest difficulty occur to a man in such a state of mind, should even his wife fail to give him the help that he needs, his worst fears will be confirmed. He returns home from his honeymoon completely convinced that he is impotent. Reassurance that he is a normal man and advice to both himself and his wife may be all that is required to bring about a cure. It is wise, however, to make certain that there is no physical obstacle to the consummation of the marriage in the way of an unusually small vagina or tough hymen. Should such obstacles exist, things will have to be made easier for the husband by dilatation.

The factor of fear is a common one and it takes many forms. Fear of sexuality and fear of women in general are quite common in men. Even although a man who suffers from such fears has met a woman with whom he expects to be at ease, his old anxieties are likely to prove an obstacle to intercourse. So also may an old bachelor-fear of contracting venereal disease continue to exert an action after marriage. The fact that the danger of this no longer exists does not neutralize what lies in the less conscious regions of the mind. But perhaps the most common of all fears is that which is associated with masturbation. So long as children are taught that masturbation is a deadly sin, fraught with the darkest consequences, so long will there be a harvest in future years of sexual neurotics and impotent husbands.

Another class of case is due to *weakness of sexual desire*. The strength of sexuality varies enormously in different men, being dependent upon individual psychological make-up and endocrine pattern. Should a weakly sexed man find himself married to a passionate woman, he may often

attempt intercourse when he has little or no desire for sexual union. Sooner or later he will fail and failure will undermine further his confidence in his sexual capacity. This may in the end lead to a functional impotence. It is particularly liable to happen if he and his wife are anxious to have a child and, as a consequence, sexual union is of increased importance. I have known the instructions given by gynæcologists that intercourse should happen on certain dates to have the effect of rendering a husband impotent. Sometimes weakness of desire is explained by the fact that the patient's wife has little physical attraction for him. He has married her for the sake of her companionship, because he wants a home, because he would like a family, but not because he has any real desire for sexual intercourse. He may even have a strong emotional feeling for his wife, but if his emotions have not been properly integrated with his sexuality he may still remain incapable of union. This failure to harmonize sexuality with emotional life is commonly met with among those who were brought up in a puritanical atmosphere. On becoming men they have divided womenkind into two categories: "nice" women, and women with whom it is possible to have sexual intercourse. I recall one husband of this kind for whom coitus only became satisfactory when he discovered that the wife, whom he had formerly put on a pedestal, had had an affair before marriage. She was no longer "nice".

So far cases of impotence due to weakness of normal desire have been considered, but there is also a large group of cases in which the impotence is the result of an *abnormality of desire*; in other words, of a deviation of sex. There is no standard pattern of sexuality, but sometimes the pattern is so unusual that it cannot be satisfied by the conditions of marriage. Sex inversion and homosexuality are examples of this. By the term sex inversion is meant a sexual impulse which is ineradicably directed towards the same sex, and by homosexuality the existence of homosexual desires in an individual who is potentially heterosexual, or at least bisexual. A man may marry without being aware of the true pattern of his sexuality or, if he be partly aware of it, in the expectation that marriage would bring about a change. In the investigation of this type of patient, sexual dreams and masturbation fantasies are of great help. When the departure from normality is small, a slight alteration of the setting and of the ritual of intercourse will sometimes supply the stimulus that has hitherto been lacking. In other cases prolonged psychotherapy will be required to bring about a cure. In yet others a reorientation of the sexual impulse is impossible and the marriage may have to be annulled.

Before passing to a consideration of treatment it is necessary to refer to two special types of case, namely, *premature ejaculation* and *absence of ejaculation*. The former of these is probably the most common difficulty found in marriage and at the same time one of the most difficult troubles to cure. Although the opposite condition, namely, difficulty or failure to obtain an emission is considerably rarer, it is far more commonly met with

than textbooks would have us believe. The failure to ejaculate is never due to any physical obstruction in the genital ducts, but to psychological causes. That this is so is shown by the fact that the patient will often have an emission in sleep a few hours after he has failed to ejaculate.

PHYSICAL TREATMENT

This may be subdivided into *treatment with drugs*, endocrine therapy, physiotherapy, and surgical procedures. In spite of man's long search for a true aphrodisiac, such a drug has not been found. Yohimbin and damiana are very erratic in their action and the most useful drugs are those which have a tonic action on the body generally, or on the central nervous system. Strychnine, nux vomica and various preparations of arsenic and phosphorus are all of service.

Endocrine therapy also has its place. The use of the male hormone is indicated in all cases of eunuchoidism, but even when this condition does not exist, the sudden flooding of the system with male hormone may well have a beneficial effect. Small doses of thyroid may also prove useful to middle-aged men complaining of a decline in their sexual capacity. It is well known that the pituitary plays a very important part in the sex life of animals, but it is doubtful whether we at present possess any anterior pituitary-like extract which is of service in cases of impotence.

A great number of *local measures* and *surgical procedures* have been used, but in my opinion they have only a very small place in the treatment of impotence. Among the measures advocated may be mentioned the passage of cold sounds and psychrophores, local applications and local diathermy to the posterior urethra, dilatation and prostatic massage. It is in the treatment of premature ejaculation that these measures have been chiefly employed. Urologists claim that this condition is due to a congestion and a hypoesthesia of the posterior urethra. Characteristic changes are described in the *veru montanum*, and on the basis of this pathology a system of treatment has been devised. Now I do not deny that premature ejaculation is occasionally the sequel of an infection of the posterior urethra, or that the various local measures advocated may not sometimes be of use, but I think that it is only exceptionally that premature ejaculation is cured by such treatment.

Recently, O. S. Lowsley (1942) has designed a special operation for those cases of impotence due to weakness of erection. The aim of the operation is to tighten up the ischio-cavernosus and bulbo-cavernosus muscles so that their action in bringing about erection is enhanced. The muscles are exposed through a perineal incision and plicated by means of sutures of ribbon gut. Lowsley states that his operation is particularly useful in cases of impotence due to perineal trauma, such as falling astride a gate, and that it is less likely to be successful with middle-aged men whose muscles are in a state of fatty degeneration. I have very little personal experience of

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Lowsley's operation, but I believe that it is based on a wrong conception of impotence. I have seen few cases of impotence which were the result of trauma, and it must be remembered that any operation on the genitalia will have a strong suggestive action on the patient's mind. I have myself cured a patient of impotence by making a small skin incision and suturing it. This patient was convinced that he had torn a ligament and I realized that nothing would cure him except an operation on a supposed torn ligament.

PSYCHOLOGICAL TREATMENT

This is undoubtedly of the greatest importance. Even when the patient suffers from some physical lesion which renders intercourse difficult, psychological factors in the form of anxiety and fear are likely to intervene, so that the impotence persists after the lesion has been cured. It is obviously quite impossible to discuss in a short article the psychotherapy of sexual difficulties, and all that can be done is to indicate the main lines of treatment. The preliminary examination of the patient must in all cases be a very thorough one, if for no other reason than to satisfy him that his troubles are being properly dealt with. More often than not he has previously seen someone else who perhaps has given him the impression that his difficulties are regarded as being imaginary. He is therefore likely to be suspicious and critical of doctors. After this searching examination the wife should if possible be interviewed. She may be able to supply useful information about her husband's attitude to sexuality and to his troubles; she may herself be a very important factor in his impotence, and her collaboration and understanding are essential if her husband is to be successfully treated. The treatment of psychogenic impotence generally demands much patience on the part of the physician and it is often very difficult. Some cases will yield to commonsense methods of treatment combined with that amount of psychological insight which every doctor who has experience of these cases must eventually obtain. Others will prove too difficult and will have to be handed over to a competent psychiatric specialist for more expert investigation and treatment. Should this be the case, the physician will have the satisfaction of knowing that he has played an important part in the treatment of his patient. He has brought him to realize that his difficulties are not, as he had previously regarded them, of a physical nature, but are psychogenic. In many cases it will be no mean achievement to have brought about this change of view.

Reference

Lowsley, O. S. (1942): "Yearbook of Urology", Chicago, p. 58.

DISORDERS OF SEX AS A MANIFESTATION OF ENDOCRINE ABNORMALITIES

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HUMAN life passes through five stages, pre-natal, pre-pubertal, adolescent, mature, and climacteric. The extent of sexual activity varies considerably from stage to stage, and the nature of sexual disorders is characteristic of the stage in which they occur. Thus the most fundamental changes take place during *embryonic* life, and congenital abnormalities of sexual structure tend to be monstrous in appearance and tragic in effect. In *infancy* and *childhood* sex development lies dormant while the organism devotes itself predominantly to growth, and disorders of sex occurring at this time therefore lead to precocious puberty. During the *adolescent* period the "neuter" child gradually acquires secondary sex characters and becomes a youth or a maiden, and it is in this phase that deficiencies of sex function become evident. In *adult life* full sexual activity is attained, and disorders are confined to inadequacies or heterosexual deviations. Finally, in the *climacteric* twilight of sex the only abnormal condition is renewed sexual function. Each disorder of sex will be described under the phase of life when it most characteristically occurs.

THE PRE-NATAL STAGE

It is agreed that sex "determination" is chromosomal, but opinions differ concerning endocrine and genetic influences in sex "differentiation".

Sex determination.—If the sperm that fertilizes the ovum carries a Y-chromosome the embryo will become a male; a female if the chromosome is X. Up to the seventh week the embryo is potentially bisexual, for by development of its cortex the gonad can become an ovary, whereas the medulla can give rise to a testis. If both elements persist to form an ovotestis, or if one gonad becomes a testis and the other an ovary, a "true" *hermaphrodite* results. This exclusively genetic abnormality is exceedingly rare—there are 39 cases in the literature to date—and can be diagnosed only by microscopical examination of tissue from both gonads: the majority of the cases have shown predominantly male secondary sex characters.

Sex differentiation.—In the "indifferent" state the embryo possesses the elements of the reproductive tracts of both sexes. The Müllerian ducts are destined in the female to become the Fallopian tubes, uterus, upper part of the vagina and hymen, whereas the Wolffian ducts provide the epididymies, vasa deferentia and seminal vesicles in the male. Both pairs of ducts, as well as the bladder, open into the uro-genital sinus, from which

the lower part of the vagina and the urethra are formed in the female, and the prostate and prostatic portion of the urethra in the male. The external genitalia consist of the phallus, flanked by the urethral folds and the labio-

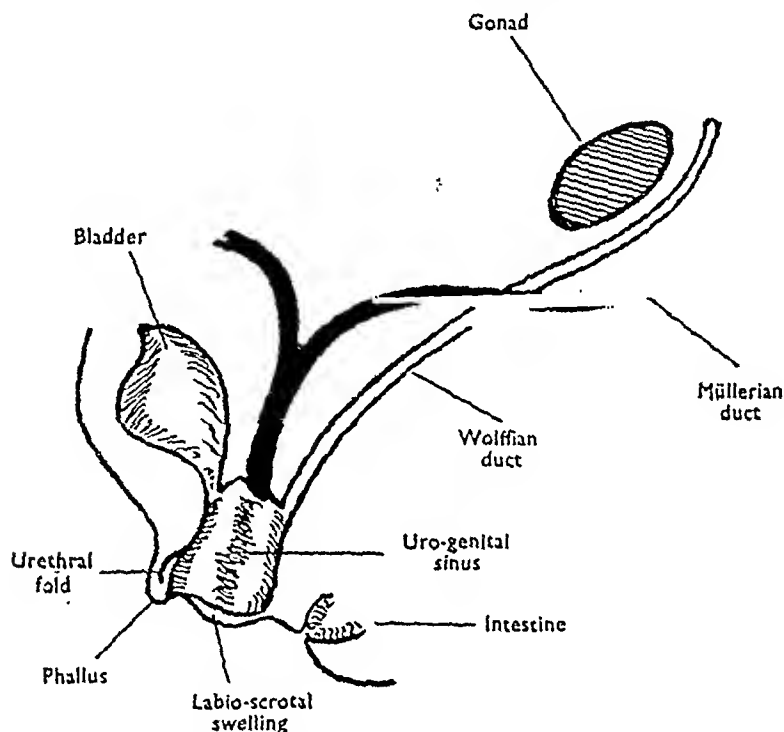


FIG. 1.—The "indifferent state of embryonic" development.

scrotal swellings. The phallus becomes either the clitoris or penis, the urethral folds and labio-scrotal swellings remain separated to form the labia minora and majora, or join together in the median raphé to enclose the penile urethra and constitute the scrotum (figure 1 and table 1).

Genetic and endocrine influences.—If chromosomal influences can determine the sex of the gonad they should be capable of differentiating the rest of the reproductive tract. On the other hand it might be reasonable to suppose that the gonad, once formed, should by its endocrine secretions control the further development of the reproductive tract.

Lillie, in his work on the freemartin, first demonstrated an endocrine influence in sex differentiation. In the uterus of the cow in which the placentas of twin embryos of opposite sex are so fused that the blood supply is common to both, the gonad of the female embryo becomes a sterile testis and the Wolffian ducts develop at the expense of the Müllerian ducts. It would seem therefore that the secretions of the gonad of the male twin, which differentiates earlier than the female gonad, have profoundly in-



FIG. 2



FIG. 3



FIG. 4



FIG. 5

FIG. 2—Turner's syndrome in a patient aged 21, who has been treated with oestrogen, and hence slight breast development and pigmentation of nipples

FIG. 3—Gynæcomastia in a youth aged 19.

FIG. 4—Eunuchoid, aged 25. Note bowed thighs as opposed to bow legs.

FIG. 5—Endocrine tumour of the testis in a boy aged 9½ (Sacchi, 1895). Excision of the large left testis which contained a carcinoma-like tumour, was gradually followed by disappearance of the signs of precocity; his beard dropped off and mentally he became more childlike.

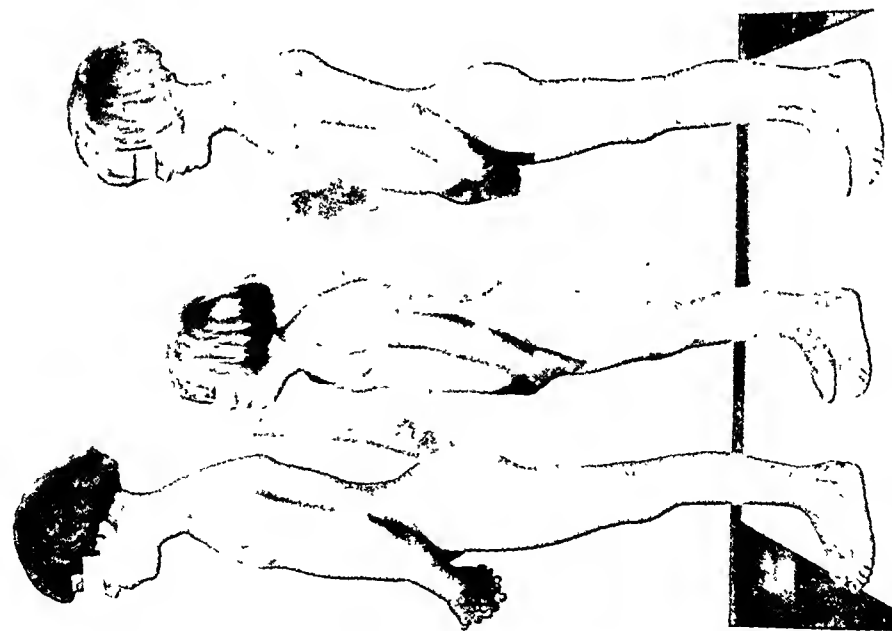


FIG. 6—Pituitary dwarfism. (a) Normal control, aged 9;



FIG. 7—Pituitary dwarfism at the age of 23 with brother aged 18.

fluenced the development of the gonad and reproductive tract of the genetically female twin.

Since Lillie's important observations in 1917, much evidence has been presented to show that endocrine influence can affect the development of the embryonic reproductive tract. Administration of sex hormones at various stages of pregnancy in amphibia, birds and mammalia, parabiotic union of amphibian embryos of opposite sex, and grafting of heterosexual gonads to chick embryos, have led to varying degrees of sex reversal and heterologous differentiation. Clearly therefore, extraneous endocrine in-

TABLE I
SEX DIFFERENTIATION: MALE AND FEMALE HOMOLOGUES

Indifferent State	Male	Female
(A) <i>Gonad</i> Cortex Medulla	Testis	Ovary
(B) <i>Genital ducts</i> Wolffian duct	Epididymis Vas deferens Seminal vesicle Appendix testis Utricle	Paroophoron Gartner's duct
Müllerian ducts	Verumontanum Prostate Prostatic urethra	Fallopian tubes Uterus Upper part of vagina Hymen Lower part of vagina Urethra
(C) <i>Uro-genital sinus</i>		
(D) <i>External genitalia</i> Urethral folds Labio-scrotal swellings Phallus	Penile urethra Scrotum Penis	Labia minora Labia majora Clitoris

fluences can profoundly change the course of sex differentiation, but this is no proof that the intrinsic secretion of the embryo's own gonads normally directs this course, although the fact that the gonad differentiates before the rest of the reproductive tract is suggestive. Here the work of Carl Moore (1944) is of great significance.

Moore was a student of Lillie's and has devoted nearly thirty years to this problem. His conclusions are that, although intrinsic endocrine influences may affect sex differentiation, the normal embryonic gonad has no such function. His most convincing studies are on the opossum. This animal is born on the thirteenth day of gestation in a sexually undifferentiated state: for the next sixty days it lives firmly attached to nipples within the maternal pouch until it has completed its development. Moore was unable, by injecting pituitary gonadotrophic hormone, to stimulate the embryonic gonad to secrete its characteristic hormone until about the seventieth day, by which time the reproductive tract was already differentiated. Furthermore, gonadectomy performed before the one-hundredth day of life produced no evidence of lack of stimulation of the reproductive tract; extrinsic administration of the homologous sex hormone at an early stage of development, however, led to precocious differentiation. Thus, in this animal, the normal embryonic gonad does not influence the natural course of sex differentiation, which is therefore presumably

genetic, although extraneous endocrine influences may have a profound effect in this direction.

This throws some light on the origin of the two main types of pseudo-hermaphroditism, the principal features of which are summarized in table 2.

TABLE 2
PSEUDO-HERMAPHRODITISM

Reproductive Tract	Male Pseudo-hermaphroditism	Female Pseudo-hermaphroditism
(A) <i>Gonad</i>	Testis, sometimes undescended	Ovary, usually infantile
(B) <i>Genital ducts</i> Wolffian duct	Epididymis, vas and vesicle either normally developed, rudimentary or absent	Epididymis, vas and vesicle usually absent; occasionally a rudimentary vas present
Müllerian ducts	Tubes and uterus sometimes present	Tubes and uterus present; uterus usually infantile, tubes normal or poorly developed
(C) <i>Uro-genital sinus</i>	Vagina commonly present, sometimes opening into the urethra, sometimes on to the surface Prostate usually small or rudimentary and sometimes undetectable	Vagina usually present, often opening into the urethra Prostatic tissue often present, sometimes well-developed
D) <i>External genitalia</i> Urethral folds	Penile urethra nearly always absent with perineal hypospadias	Urethral opening in perineum Labia minora often absent or rudimentary
Labio-scrotal swellings	Scrotum normal, cleft, or labial and leading to vagina	Poor labial development, often resembling cleft scrotum
Phallus	Hypertrophied "clitoris" or small penis	Hypertrophied clitoris or small "penis"
(E) <i>Secondary sex characters</i>	Usually male hair distribution on chin and pubis Male breasts Sometimes female pelvic configuration Mentality usually male	Considerable hirsutism Breasts usually very poorly developed Often male pelvic configuration Mentality usually female

In male pseudo-hermaphroditism there is failure of complete sex differentiation, sometimes with persistence of Müllerian duct elements, such as tubes and uterus, and of female uro-genital sinus derivatives, such as a vagina. There is always incomplete differentiation of the external genitalia. The grades of male pseudo-hermaphroditism vary considerably and the con-

dition may be represented in its mildest form simply by hypospadias. At the opposite extreme the sex of the individual can be determined only by biopsy of the gonad. It is possible that these congenital abnormalities are due entirely to chromosomal defects, although it has been suggested that they may be due to endocrine disturbances, such as failure of androgenic secretion of the embryonic testis leading to incomplete development of the male elements of the reproductive tract and persistence of some of the female elements, or excessive secretion of maternal oestrogens at some stage of embryonic life. In view of Moore's findings it is difficult to accept the first theory, although the second would be conceivable.

Female pseudo-hermaphroditism chiefly affects the external genitalia, like the male variety, from which it often cannot be distinguished by ordinary clinical examination. The ovaries are almost always poorly developed, and the remaining female elements of the reproductive tract are generally infantile. The male influence is usually less marked higher up the reproductive tract than in the external genitalia, and although prostatic tissue is frequently present, there is seldom any marked persistence of the Wolffian duct. Secondary sex characters and the psychological sex vary considerably in both forms of pseudo-hermaphroditism and often fail to indicate the true sex of the individual, although it is usually important to try to adjust the physical structures to conform with the sexual inclinations. Hyperplasia of the adrenal cortex has been found in many cases of female pseudo-hermaphroditism and it has therefore been suggested that the condition may be due to excessive secretion of foetal cortical androgens.

The undescended testicle is another congenital abnormality which may be of endocrine origin. The so-called "luteinizing" gonadotrophic hormone of the pituitary influences the descent of the testicle in the following way. First, it increases the size of the testicle and thereby mechanically aids its descent; secondly, it brings about development of the connective tissue elements associated with the testicle in its descent, thus lengthening the structures of the cord; and thirdly, it stimulates androgen secretion by the testicle itself, which in late embryonic life may assist in its descent. Administration of a pregnancy urine extract with properties similar to those of the luteinizing hormone may therefore induce descent of a testicle which has failed to reach the scrotum solely through lack of gonadotrophic stimulus. Indeed the spontaneous descent which sometimes occurs in late puberty may be due to the increased secretion of gonadotrophins at this time. On the other hand, the testicle may fail to descend through mechanical obstruction, such as a hernial sac or the presence of fibrous bands anchoring it to the pubic spine or elsewhere. It is therefore important to consider the cause of the condition before selecting the appropriate treatment. For this purpose it is helpful to classify undescended testicles into three groups, abdominal, canalicular and extra-canalicular.

The descent of the *extra-canalicular* testicle is more often "impeded" or

"deviated" than "delayed". It is inconceivable that a testicle which is bound to the pubic spine could be steered to the scrotum by any endocrine influence. On the other hand, it is a simple matter for the surgeon to free the band and place the testicle in its proper position. Again, it is unlikely that any hormone could induce a testicle, which after emerging from the external ring has doubled back to lie in the loose areolar tissue superficial to the inguinal canal (sometimes called the superficial inguinal pouch), to turn a somersault and slide into the scrotum. But it is easy for the surgeon to pick the testicle out of the superficial inguinal pouch, or indeed out of any of the other "ectopic" pouches, perineal, pubic or femoral, and place it in the scrotum. Even if the descent of the extra-canalicular testicle is simply "delayed" it may reach the scrotum spontaneously by the time of early puberty. Thus endocrine therapy plays little part in the treatment of the extra-canalicular testicle, and surgery is highly satisfactory because the cord is not short and the testicle can be brought to the scrotum without undue tension.

The testicle may be *canalicular* because it is impeded by a hernial sac or patent processus vaginalis which never reaches the scrotum, or because of some rare mechanical obstruction, such as that formed by the intercolumar fascia being stretched as a firm sheet across the external ring as an impassable barrier. But in the majority of cases a canalicular testicle fails to descend because the cord is too short. This presents the surgeon with a more difficult problem; careful dissection high up in the region of the internal ring, and possibly some device to retain the testicle, such as placing it through the scrotal septum into the contralateral side, may be necessary. Even if he succeeds in obtaining a good anatomical result the tension on the cord may seriously endanger the blood supply to the testicle, which may consequently atrophy. Fortunately, however, in about 50 per cent. of cases, the canalicular testicle responds successfully to endocrine therapy. Thus endocrine treatment is the method of choice with canalicular testicles, and if surgery must be resorted to it should be practised by the most skilful and experienced surgeon available.

If the testis is *abdominal*, which is fortunately a rare condition, it is almost certainly undeveloped and likely to prove functionless even if it could be brought to the scrotum surgically. Although the task may be equally hopeless for the endocrinologist, every effort must be made to stimulate testicular development, if the condition is bilateral, because the alternative is not only aspermia but also androgenic deficiency which will lead to *eunuchoidism*.

An important consideration is the age at which treatment should be undertaken. Spermatogenesis begins early in puberty, between the ages of nine and twelve. So long as the testicle is functionally a "neuter" structure its position is of no concern, but once it is capable of producing sperms it must reside in the cool environment of the scrotum if sperm production is to flourish, and the longer it remains undescended the more certain is its

capacity to produce sperms to be permanently damaged. It is therefore essential, especially in bilateral cases, that the undescended testicle should be treated before the age of twelve, and the possibility of spontaneous descent occurring at about the age of fourteen should not be used as an argument to delay treatment.

THE PRE-PUBERTAL STAGE: THE CAUSES OF PRECOCIOUS PUBERTY

Precocious puberty is uncommon; nevertheless its manifestations are so striking that the abnormality of the patient's condition is usually in little doubt. On account of the importance, and sometimes the urgency, of appropriate treatment, localization of the responsible lesion is imperative. It should be borne in mind, especially in children over the age of eight, that the condition may simply be a physiological antedating of the normal age of puberty, due to constitutional or racial factors; nevertheless, this cannot be assumed until all the possible pathological causes have been excluded. These are:—endocrine tumours of the gonads, adrenal cortical tumours, pineal tumours and tumours in the region of the hypothalamus.

Endocrine tumours of the gonads

(1) Granulosa cell tumour of the ovary: This is a growth of the cells responsible for producing the oestrogen which the normal adult ovary secretes. It may appear at any time of life; indeed its greatest incidence is between the ages of thirty and fifty, when it may present no symptoms by which its true nature can be certainly diagnosed. About 10 per cent. of the cases occur before puberty and about 30 per cent. after the menopause. Before puberty it gives rise to obvious breast development, enlargement of the labia and clitoris, growth of pubic hair, and uterine bleeding, which is usually irregular and excessive. Diagnosis depends upon palpating the ovarian tumour per rectum. Treatment is surgical, and prognosis is usually good, all signs of precocity disappearing rapidly.

(2) Interstitial cell tumour of the testicle: This exceedingly rare tumour—only 4 pre-pubertal cases have been described in the literature—affects the cells which in the normal adult secrete the testicular androgen. The external genitalia assume adult proportions, and there may be growth of pubic, axillary, facial and body hair similar to that of the fully developed male. There is usually also some increase in statural growth. In the child the condition is not malignant and the prognosis after surgical removal is good. These tumours are equally rare in adults, but some of the cases have been malignant.

Adrenal cortical tumour.—As this condition is dealt with elsewhere in this number, in an article by L. R. Broster (p. 307), detailed description is unnecessary here. Before puberty the tumour is often malignant, and occurs much more often in girls than in boys. Male secondary sex characters predominate in both sexes. In females there is enlargement of the clitoris,

but uterine bleeding seldom occurs. Hirsutism is a feature in both sexes, and a plethoric, full-moon face with obesity of the trunk and shoulder girdle, suggestive of Cushing's syndrome, is not uncommon.

Pineal tumour.—This rare tumour may occur at any age, about 30 per cent. appearing in childhood, of which only a small number give rise to precocious puberty. These have all occurred in boys. The testicles and external genitalia grow to adult size and there is deepening of the voice and precocious heterosexual interest. There may also be some degree of mental precocity and accelerated statural growth. Finally, there is usually some sign of intracranial involvement, such as internal hydrocephalus, choked discs, oculomotor disturbances, deafness, spasticity of the limbs or a positive Babinski sign. Removal of the tumour has led to cure. The endocrine nature of these growths is little understood. They are said to result in simple over-activity of the gland, which is therefore thought to be concerned with normal sex development; on the other hand, it has been suggested that the tumour destroys the function of the gland, which is to prevent puberty from appearing until the natural age. Finally, it is possible that the tumour involves the hypothalamic-pituitary pathway and stimulates the pituitary to secrete gonadotrophic hormones.

Tumours in the region of the hypothalamus.—These are also very rare findings. They have been described in both males and females, and give rise to full sexual development and, in some cases, intracranial involvement. Boys develop unnatural physical strength and powerful, muscular physique, sometimes with obesity. The voice is deep, the genitalia of adult size, and erections and emissions are experienced. In girls, secondary sex characters are well marked, with considerable breast development and precocious menstruation. Treatment is difficult and prognosis therefore uncertain. The endocrine symptoms are almost certainly due to pituitary stimulation.

THE ADOLESCENT STAGE

The somatic sex of the infant is obvious and the psychological sex of the child is seldom in doubt, but functional sex appears first after puberty and it is then that deficiencies of sex function become evident. During the first two or three years of adolescence they may be difficult to detect with certainty and "delayed puberty" is a convenient provisional diagnosis, but between the ages of sixteen and eighteen this can, with more confidence, be altered to "ovarian deficiency" or "eunuchoidism".

Delayed puberty.—The age of puberty varies considerably. It tends to begin earlier in boys than in girls. The first stages of spermatogenesis probably begin at the age of nine or ten; pubic hair appears between eleven and thirteen, and the testicles double their size between twelve and fourteen. Emissions, axillary hair growth and voice changes occur between fourteen and sixteen, and shaving becomes necessary between the ages of sixteen and eighteen. In the girl, puberty is more dramatically heralded by the menarche,

which usually occurs between the ages of twelve and fourteen, although breast development and pubic hair growth often precede it. These dates are, however, extremely variable in normal adolescents; the menarche may occur at the age of nine, or, on the other hand, the first period at eighteen may be followed by a perfectly normal, regular menstrual cycle. Lack of signs of puberty, such as incipient pubic hair growth and testicular enlargement, by the age of fifteen or sixteen, should suggest watchful waiting rather than officious endocrine therapy.

Ovarian deficiency.—This condition varies considerably in degree. The mildest form is "menstrual instability": the menarche is late, at fifteen to seventeen; then follow some months of amenorrhœa, and later an oligomenorrhœic pattern leads on to secondary amenorrhœa and an early menopause. This condition is often associated with mild hirsutism and acne, indicating disturbance of the functional balance between ovarian and adrenal cortical activity, and acrocyanosis as a manifestation of the ovarian deficiency. "*Primary amenorrhœa*" denotes a more severe degree of ovarian deficiency. It should not be diagnosed until the age of eighteen. It may be secondary to pituitary deficiency, or it may be due to varying degrees of primary ovarian failure, of which the most severe example is *Turner's syndrome of ovarian agenesis*, in which the ovarian tissue has been found on peritoneoscopy to be completely rudimentary. Statural as well as sexual infantilism occurs, with a height of less than 5 feet and primary amenorrhœa. Pubic and axillary hair are scanty. The breasts remain undeveloped and the epiphyses ununited. The blood pressure is usually raised. Congenital abnormalities, such as webbing of the neck, marked increase of the carrying angle at the elbows and coarctation of the aorta may also occur. Excess of "follicle-stimulating" gonadotrophic hormone in the urine distinguishes the condition from primary amenorrhœa due to *pituitary failure*. This is also associated with infantilism, but there is usually some obesity, and complete lack of pubic and axillary hair. Ovarian failure may also be secondary to *thyroid deficiency*, but the typical cretin is easily recognized, and mild degrees of hypothyroidism are uncommon in childhood and seldom affect ovarian function. The endocrine treatment of ovarian deficiency is beyond the scope of this article.

Eunuchoidism.—Failure of development of the external genitalia, scanty growth of sexual hair, beardless chin, and a high-pitched voice, call attention to the failure of androgenic secretion. Erections and emissions are not experienced, and sterility, of course, is absolute. Ununited epiphyses with disproportionate growth of the long bones complete the picture of eunuchoidism. The testicle may not develop during embryonic life, or may not descend in childhood. Pituitary deficiency, with obesity or infantilism or, more rarely, congenital thyroid deficiency, accounts for some cases, but often no reason for the testicular agenesis or atrophy can be found. Treatment with androgens is obviously indicated, and implantation of six or

eight 100-mgm. pellets of testosterone, repeated every six months, gives partial relief. Erections occur, the penis may enlarge, there may be some growth of pubic hair, and the voice may break. The most marked change, however, is psychological. The eunuchoid is timid, apprehensive and un-initiative; under treatment he becomes self-confident and acquires a typical male aggressiveness.

THE MATURE STAGE

In adult life, disorders of sex are confined to heterosexual manifestations and functional deficiencies. Despite the occurrence of endocrine tumours, homologous overactivity of the gonads is practically unknown; on the other hand, deficiency is not uncommon, although its clinical manifestations are usually mild and difficult to detect. In the male, for instance, gross androgenic deficiency is rare and almost always associated with a history of testicular damage or removal, but *defective spermatogenesis*, the most prevalent testicular failure, is often unsuspected until it is discovered in the course of the investigation of infertility, when it is found to be present in up to 50 per cent. of cases. To what extent impotence and premature ejaculation are endocrine rather than psychological in origin is a matter of some doubt. In the woman, adult ovarian deficiency is usually associated with *menstrual disturbances* and sterility due to *failure to ovulate*. Detailed consideration of these conditions is beyond the scope of this article.

The heterosexual disorders of adult life consist of feminization in the male and masculinization in the female. They are exemplified by:—

(1) *Gynæcomastia*.—The association of this condition with endocrine tumours is exceedingly rare, although malignant growths of the testicle (carcinoma, teratoma and chorionepithelioma) have been recorded, and four cases of adrenal cortical tumours with gynæcomastia reported. The cause of the breast enlargement is still in doubt, for it has been found to occur in Graves's disease, in Addison's disease treated with cortical extract or desoxycorticosterone, in cirrhosis of the liver, in leprosy, as well as in many cases in which no other abnormal finding is present. The administration of oestrogens can of course produce it (and in cases of carcinoma of the prostate treated with adequate doses of stilboestrol, gynæcomastia with pigmentation of the nipples nearly always develops), but it is certainly not always due to excessive oestrogen stimulation, or to increased sensitivity of the breast tissue to normal male levels of oestrogen secretion. Its association with hypogonadism had been noted from time to time, but was not well established until the recent description of a syndrome by Klinefelter, Reifenstein and Albright (1942), the principal features of which are hyalinization of the seminiferous tubules of the testicle and gynæcomastia. The condition usually becomes noticeable about late puberty. There is an abnormally high excretion of follicle-stimulating hormone in the urine, with diminution of androgens and oestrogens. Androgenic deficiency is

variable and not usually well-marked, although the testicles are always small and the patient completely aspermic. The gynæcomastia must of course be distinguished from puberty mastitis, in which there is a transient tender swelling of the breast, and which must be regarded simply as a physiological disturbance of sex-hormone balance occurring at puberty. There is no effective endocrine treatment for gynæcomastia and should it prove embarrassing the only remedy is cosmetic surgery.

(2) *Virilism*.—This varies from slight hirsutism of the upper lip, cheeks and chin, with perhaps some hypertrichosis of the arms and legs and masculine distribution of pubic hair, to marked growth of superfluous hair, associated with male alopecia, amenorrhœa, acne, atrophy of the breasts, deepening of the voice, and enlargement of the clitoris. Most cases, especially the milder ones, merely indicate a slight functional disturbance of balance between ovarian and adrenal cortical activity, and it is rare for the condition to be associated with an actual tumour of the adrenal cortex or a basophil adenoma of the pituitary. The most valuable aid to diagnosis is the estimation of the 17-ketosteroid (or androgen) content of the urine. Figures up to about 40 mgm. a day (about three times the normal) are commonly found, but in the presence of an adrenal tumour the figure is in the region of 100 mgm. or more, with increased quantities of dehydroisoandrosterone, whereas in normal cases and benign virilism, androsterone is the principle 17-ketosteroid isolated. In Cushing's syndrome the 17-ketosteroid content is not excessive, but there is an increased excretion of corticosteroid. Endocrine therapy is completely ineffective in cases of hirsutism, and in most cases local removal of the superfluous hair is the only remedy that can be offered. When there is a tumour of the adrenal cortex, surgery is indicated, but it is doubtful if removal of one adrenal for simple virilism is justified. Rarely, virilism is produced by an *arrhenoblastoma of the ovary* (these growths comprise not more than 1 per cent. of solid ovarian tumours). Unfortunately it is not easily detected clinically, because it is of moderate size and may not be identified on bimanual palpation. The tumours tend to occur in young women and are not usually malignant. Although they should be considered in the differential diagnosis of virilism, laparotomy is not justified, because of their rarity, unless there is clear evidence of enlargement of one ovary. Removal of the tumour results in complete regression of the symptoms.

THE CLIMACTERIC STAGE

Disorders of sex occurring at this stage of life are practically confined to women and give rise to post-menopausal bleeding. The only endocrine cause of this bleeding is excessive secretion of œstrogen from either a *granulosa or theca cell tumour of the ovary*. Probably the most common cause of post-menopausal bleeding in recent years is therapeutic overdosage with œstrogen, the second most common cause being carcinoma of the uterus.

Bleeding due to endocrine ovarian tumours is rare, but it may be suspected if there are other manifestations of œstrogen activity, such as redevelopment of the breasts.

CONCLUSION

An attempt has been made in this article to describe every disorder of sex due to endocrine causes. It must be emphasized, however, that most of them are rare conditions, and the practitioner may encounter few in his professional experience. Let him therefore be cautious in his diagnosis of these rare conditions, and remember that the endocrine disorders of sex which he will daily encounter will seldom be dramatic, and therefore all the more difficult to diagnose and treat.

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THE ADRENALS IN SEX

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A NORMAL sexuality is perhaps the most enviable of all human endowments. It is biologically fundamental, for it embraces not only the contentment of the individual, but the harmony and happiness of both the sexes in marriage. Variations from normal standards are therefore peculiar to each sex.

There are many factors concerned in the evolution of sex. Primarily it should be regarded as a psychosomatic problem in which the adrenal cortex has been credited with an early and effective part.

THE BIOLOGICAL CONCEPT OF SEX

Sex, with the instincts of growth and self-preservation, form the tripod of life. Instinct in its simplest terms has been defined by Trotter as "inherited modes of reaction to bodily need and external stimulus". As the *modus vivendi* it is the universal law of nature. It is the innate urge of all living things to survive, and as such has been the guiding principle of creative and retrogressive evolution, effecting both structure and function alike, not only of the individual, but also of the species. Unlike growth and self-preservation, the instinct of mating and reproduction is confined to the adult and active time of life, and is seasonal and phasic in operation. At the times when it becomes operative it impinges on the emotional centres of the brain, and the reactions become widespread. Instinctive reaction, although akin to nervous reflex action, is more complex and delayed, and influences the individual as a whole. The nervous reflex is local and instantaneous, and like a penny in the slot gives the same result. Oft repeated it leads to subconscious and automatic performance of a complicated act, but this goal is only achieved by a process of learning, and effort of will. Sooner or later it becomes a habit, requiring no mental effort, and so a process of living economy. The nervous reflex is therefore under control of the will, and when other reflexes are added the result becomes confused and unpredictable, unless these new reflexes are conditioned by an elaborate process of training. However, if powerful extraneous stimuli are added, ordinary reflexes will be discarded in favour of those long inherited instinctive reactions which maintain survival. Thus instinctive reactions require no learning, and when they occur within the limits of bodily comfort usually give pleasure and satisfaction. In the lower reaches of the brain, in the juxta-pituitary and hypothalamic region of the mid-brain, lie the emotional centres. Here the centres of rage and fear have been demonstrated by animal experiment. If the fore-brain is severed above these centres the animal passes into a condition of "sham rage", indicating a loss of emotional control by the cortex. The bodily responses to stimuli like pain and emotion also act as reflexes, but when the stimuli are maximal the responses like-

wise pass control of the will. This hypothalamic part of the brain is known as the head ganglion of the autonomic system, and through the parasympathetic and sympathetic fibres controls the lower or vegetative functions of the body, and this mechanism in the discharge of its functions works in conjunction with the endocrine system.

SEXUAL ABERRATIONS

On this background of cortical, autonomic (nervous), and chemical (endocrine) control let us analyse the types of biological aberration as they are observed in clinical medicine. In the first place there are two definite processes. One, the more common, is the masculinization of the female; the other, rarer and less understood, the feminization of the male. In both of these the adrenal cortex plays an early and prominent part, long before the gonads come to maturity, so the adrenal cortex must be regarded as an accessory sex organ, exerting its influence during embryonic life. Evidence in favour of this view is to be found in recent work showing that the protoplasm of the cells of the cortex in the sexually abnormal patient take up quite a different stain from the cortical cells in normal persons; that is, with the differential ponceau-fuchsine stain of Vines they assume a vivid red colour (fuchsine) in contrast to the normal colour, aniline blue. There is not only a more marked clinical picture according to its intensity, but correlated with this stain an increased amount of androgenic substance is recoverable in the urine of women with virilism, and this excess can be decreased by the operation of unilateral adrenalectomy. It is not clear why, without some antecedent factor, signs of masculinization should crop up sporadically in women who have passed through puberty normally. That such a factor is present derives from the observation that this fuchsine stain appears in the foetal cortex of both sexes in a temporary and transitory manner, roughly between the tenth and twentieth week of foetal life. It would seem a paradox for the female embryo to pass through what is virtually a "male phase"; nevertheless, it appears to remain as a latent tendency, which may be activated in times of physiological stress any time in later life. Occasionally this "male phase" may fail to disappear at the twentieth week, and remain strongly marked during the time when the foetal endocrine system is becoming integrated, and even up to the time of birth. In such circumstances the female child will be born with an enlarged clitoris. Indeed, it is not difficult to argue that when these events take place during the time when the sex characters are being differentiated, complete sex reversal of the female-determined foetus can take place *in utero*, similar to that which naturally occurs in the adult of certain lower animals. It must be remembered that the foetal adrenals are large organs, each about one-third the size of the corresponding kidney. At birth they undergo a marked and unexplained shrinkage in size to their normal proportion maintained throughout life. When this shrinkage fails to take place the child is born an anencephalic monster. That some biological abnormality of this

type exists of varying potency and duration, occurring at a time when active differentiation is going on in the plastic foetus, is reflected by the number of patients with differing degrees of intersexuality who are observed clinically. Here there are at least seven grades that can be classified between the extremes of female and male, as the following table shows:—

TABLE 1
TABLE OF INTERSEXUALITY

<i>Clinical Diagnosis</i>	<i>No. of cases</i>	<i>Up- bringing</i>	<i>Gonad</i>	<i>Genitalia</i>		<i>Sexuality</i>
				<i>Female</i>	<i>Male</i>	
Secondary virilism	25	Female	Degenerate ovary	Small uterus and vagina	Clitoris normal or slightly enlarged	Mostly female; some male
Primary virilism	5	Female	Functionless ovary	Infantile uterus and vagina	Penile clitoris	2 indefinite, 2 male, 1 female
True hermaphroditism	1	Male	Ovotestis	Infantile uterus	Penile hypospadias	Male
Intersex	1	Female	Small and immature testis in position of the ovary	Infantile bicornuate uterus	Penile hypospadias	Indefinite
Cryptorchid	1	Female	Large testis in position of ovary	None	Marked penile hypospadias	Male
Partial cryptorchid	1	Female	1 abdominal 1 inguinal testis	None	Marked penile hypospadias	Female
Bilateral undescendent	4	Female	Inguinal testes	None	Penis cleft scrotum	3 female 1 male

Although these groups are clear-cut on pathological grounds, minor differences in the accentuation of the secondary sex characters, or between the primary and secondary sex characters themselves, may be observed, for it seems that any combination of sex characters may exist in varying degree among these intersexual individuals.

The rôle of the foetal cortex would seem to be determinate. In virilism it is hypertrophied, in marked cases much so, but as testicular substance appears in the intersex group the cortex begins to recede to normal proportion. It is only by postulating a general causation of varying intensity that we can bring into some semblance of order what otherwise would be a chaotic clinical classification. With such variations in the structural and functional pattern of individuals, it is not surprising that the psyche may be similarly affected. The sexuality of these patients is often feebly expressed; it generally does not necessarily accord with the sex they have been brought up in; in a few cases it is quite abnormal.

ADRENOGENITAL SYNDROME

Let us now turn to the question of overactivity of the adrenal cortex as it occurs in the masculinization of the female. Although particular endocrine syndromes are described and remain clear-cut, they are essentially polyglandular, and depend upon the reactions of the other glands in the endocrine series to the causative factor, and so are apt to vary in detail. The condition of virilism is distinguished by the appearance of male secondary sex characters in the female, and the more marked this feature is, the greater is the suppression of the feminine sex characters and function. It depends upon the age of onset. If it occurs before puberty the syndrome is marked and the adrenal glands are much enlarged, whereas if it occurs after puberty, when the secondary sex characters have been established, the clinical condition is more insidious and the glands normal or slightly hypertrophied. The syndrome may be summarized as follows:—

(1) *Male changes*.—(a) There is a shift towards the male figure, involving skeletal structure, muscular development, and distribution of subcutaneous fat.

(b) The clitoris may be enlarged.

(c) The voice is deep and the larynx enlarged.

(d) *Skin changes*. There is a growth and distribution of hair of the male type, even baldness, with coarsening of the texture of the skin and acne eruptions.

(2) *Female changes*.—(a) The breasts either do not develop, or they remain small, and even retrogress in size after full development.

(b) The external genitalia are poorly developed.

(c) The uterus is small or infantile.

(d) The ovaries are either immature, or later become cystic and degenerate.

(e) The menses never appear; if they do they are irregular, scanty or cease altogether.

(f) Fertility is decreased.

(3) Associated with these somatic changes certain psychological symptoms may appear.

Group I.—Here, in the most advanced manifestation of the syndrome, the symptoms arise during puberty, when hair begins to grow and the secondary sex characters fail to appear, and the menses do not start. Occasionally the condition may be noticed early, when the clitoris is enlarged or when there is a premature growth of pubic and axillary hair. The figure is muscular and athletic, resembling that of a boy, the chest is flat and broad, the pelvis narrow, and the limbs short. I have operated on sixteen cases, varying from the age of one to thirty-one. They have all had male figures, hirsuties, deep voices, and enlarged clitorides, either small or no breasts, and primary amenorrhœa.

The weight of the gland removed at operation in this series has varied from 10 to 48 gm. (normal 2 to 3 gm.). There has been little to choose between the size of the two glands. The larger the gland the more pigmented it is, resembling the spleen in colour. The ketosteroid excretion rises with age, from a figure of 6 mgm. a day in a child of five to 75 mgm. a day in a girl of twenty-two. The average in a series of seven estimations shows a daily output of 37 mgm., which was reduced by unilateral adrenalectomy to an average of 23 mgm., a reduction of just under 50 per cent. Although

these patients look so fit and strong, they are poor operative risks. Two patients in this series died, passing into a condition similar to acute hyperthyroidism with a rising pulse rate and falling blood pressure. It is obvious that the remaining gland, so much larger than normal, is still capable of exerting its abnormal function.

In one patient at the age of seven I removed a large adrenal, with a resultant drop in the ketosteroid output from 37 mgm. to 22 mgm. a day. During puberty the condition worsened and she became an embarrassing problem to her family. The ketosteroid excretion had now risen to 100 mgm. a day, and a subtotal resection of the remaining gland was attempted, but with fatal results.

From experience so far it would seem that the limits of surgery begin to be reached when the adrenals each weigh over 25 gm., and the ketosteroid output exceeds 100 mgm. a day. The remainder of the patients have remained well and live useful lives, but like the intersexes they remain martyrs to their neuterdom.

Group 2.—In the next group of patients, a much larger group, the clinical signs of virilism are less obvious. After passing normally through puberty they sooner or later begin to develop male hirsuties and menstrual irregularity; the periods tend to become scanty or to cease for varying intervals. These patients seek advice for this condition, with or without accompanying psychological symptoms, or for an associated pathological adiposity.

In this series eighty-eight unilateral adrenalectomies have been performed with no mortality. The weight of the adrenal gland removed has varied from 2 to 3 gm (normal) to 8.8 gm. A definite correlation has been found between the intensity of the fuchsine stain and the physical condition, for a small gland with a vivid stain may cause more noticeable changes than a larger gland where the staining is moderate or patchy.

The biochemical results have shown that the average ketosteroid excretion in forty-one tests is 17.6 mgm. a day (normal 7 to 14 mgm. a day), and 8.5 mgm. a day post-operatively, representing a drop of about 50 per cent. When the fall is greater, giving a low post-operative figure, the clinical result is better. Microscopic evidence has revealed that the ovaries have undergone follicular cystic degeneration.

The operative results are summarized in the following table (page 312). In no case has there been any obvious deterioration in health after operation, so that it may be presumed that the progress of the syndrome has been arrested. In this series of eighty-eight cases there have been fifteen with an abnormal psyche, and fourteen akin to Cushing's syndrome. The latter acquire an abnormal adiposity associated with such signs as a reddish discoloration of the face and extremities, and of the striæ distensæ radiating out from the pubis, probably due to the increased number of red cells and high colour index, a high blood pressure, and secondary metabolic symptoms, such as a low sugar tolerance and increased cholesterol in the blood. The importance of this group lies in the fact that it brings the hyperplasias into line with the adreno-cortical tumours, which can be differentiated from Cushing's syndrome (pituitary basophilism) by means of the ketosteroid

test. The differential diagnosis of this has been published elsewhere (Broster, 1940).

TABLE 2

Average age twenty-six. Observed over sixteen years. Mortality nil.

	Cases	Cushing's	Psychological
Group II	88	14	15
Good	16	2	5
Improved	45	11	8
I.S.Q.	10	1	2
Deficient information	14	—	—
Died from other causes	3	—	—

The general result of this operation is to suppress the process of masculinization and to restore the feminine form and function. Chief of these is the hair, which can be pulled out fairly easily soon after operation, and gives these young women the opportunity, according to their assiduity and inclinations, of rendering themselves more presentable. The effect in individual cases has been variable, but it does not prevent the hair from growing. The majority of patients were satisfied with their improvement. The effect of the operation on menstruation has been variable, although most patients obtained some relief in this respect, and the threshold of fertility has been improved. The general health has improved in nearly all cases, so has the depression and the migrainous headache, which are common features, but the loss of weight has been variable. There are obviously complex factors at work in such a wide range of symptomatology, in which the adrenal plays the main and variable part in a polyglandular syndrome, and the present state of knowledge does not permit prediction with precision of the amount of benefit which will accrue to any given individual, but in well-selected cases the operation is undoubtedly successful in the amelioration of the condition.

PSYCHOLOGICAL RESULTS

Whatever the problem of cause and effect may be, there is no doubt that certain abnormal psychological conditions may be associated with the syndrome, mainly with regard to the sexuality. In fifteen patients in whom such abnormality existed before operation there was improvement in thirteen and failure in two. As the syndrome carries with it characters not normally feminine, it is not surprising that these women, conscious of their abnormality, become depressed and revolt against what is fundamentally an unjust biological imposition, finding little understanding within the narrow confines of our social conventions. They become shy, secretive, and self-conscious, frigid, emotionally upset, and at times despairing. Later they may become difficult to manage, wayward, capricious, uncooperative, slovenly in their appearance and habits, and may even develop actual delusions either of a subjective kind or of persecution and ostracism. Nor is it surprising that any amelioration of their physical and functional disabilities towards their proper sex should be followed by improvement in their psychological outlook. More obscure is their increased sexuality, the



1A



1B



3

FIG 1A—Group I virilism, age 7

FIG 1B—Group II virilism Same case at the age of 14

FIG 2—Group II virilism

FIG 3—Group I virilism at the age of 26

test. The differential diagnosis of this has been published elsewhere (Broster, 1940).

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Average age twenty-six. Observed over sixteen years. Mortality nil.

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feeling of euphoria, and sooner or later the loss of their delusional states which follow operation. Two of the most advanced cases of this kind have been reported by Clifford Allen, and have remained well for eight and two years respectively.

In the advanced Group 1 cases, the patients are too young, and their sexuality too immature to find expression, but of two patients over the age of twenty-five, both started with male inclinations, one later married twice as a woman, and the other developed a pyosalpinx after adrenalectomy.

The psychological problem with regard to the other groups in the intersexual table is even less well defined. It is generally supposed that the psyche accords with the gonad, but this is not necessarily so, for I have at the moment a cryptorchid with well-developed abdominal testes, with a predominantly feminine figure and sexuality. Indeed most of these intersexes and cryptorchids are brought up as females, and on general principles it is wise surgically to retain them in this sex. On the other hand a hermaphrodite, with an ovotestis on each side, and a predominantly male psyche, by means of a plastic operation was made into a boy and joined the navy during the war.

The same procedure was adopted in two brothers brought up as girls. At the age of twenty the elder took up massage and discovered his anatomy was abnormal, after he had won throwing the discus in the Olympic games as a woman. He afterwards married, and was quite happy in his sexuality. His brother was more introspective, failed to accommodate himself to his new sex, and committed suicide.

Another cryptorchid was admitted to the female ward, and wished to "become a gentleman". His wish was fulfilled, and his return home as Uncle James instead of Auntie Elizabeth caused a good deal of consternation in the family circle.

A more elderly cryptorchid wished to retain a feminine status, and after we had performed orchidectomy, she returned home and promptly adopted a child.

It is desirable that the sex of these individuals should be settled as early as possible, for it generally happens that parents are forced to move from one locality to another, when their child has to change from a boys' to a girls' school, or *vice versa*. It is obvious from these remarks on individual cases that the psyche may be as variable as the soma. The only legal criterion is that a man, presumably even with undeveloped gonads, may not masquerade as a woman, whereas the converse bears no penalty. Our social machinery does not cater for this type of citizen, and it is hardly fair that they should be admitted to the general wards of the hospital, so the medical adviser is left to cope with a delicate situation as best he may. The legal and moral problem add further complications still when outbursts of abnormal sexuality lead to the law courts, but it is encouraging to find that with medical progress a broader and more sympathetic understanding is being meted out to these delinquents.

Feminism in the male is a much rarer condition, and clinically is the counterpart of virilism in the female. Oddly enough it carries with it the elixir of youth, just as virilism carries the hall-marks of maturity. It must be distinguished from some of the more effeminate-looking sex intergrades who bear a structural defect in some part of the genital system. These

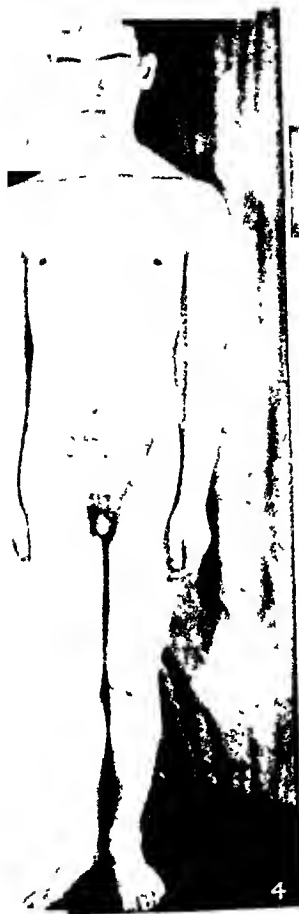


FIG. 4.—Pseudo hermaphrodite, age 14. Ovo testis in position of ovary with uterus, vagina, and cleft scrotum. Male psychology.

FIG. 5.—Male intersex with uterus, vagina, and absent left adrenal and gonad. Immature abdominal testis, hypospadias. Male sexuality. Converted into male. Age 13½.

FIG. 6.—Partial cryptorchid. One abdominal and one inguinal testis. Male sexuality. Cleft scrotum. Converted into male. Age 18.

FIG. 8.—Undeveloped male with cleft scrotum and descended testes. Converted into male. Age 11.

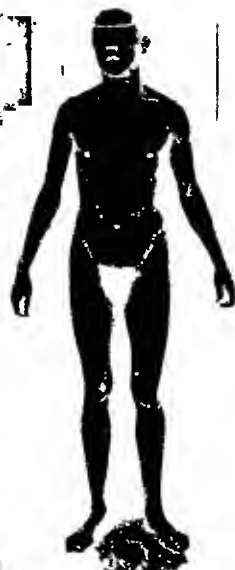


FIG. 7.—Partial cryptorchid. One abdominal and one inguinal testis. No uterus pseudo-vagina. Female sexuality. Converted into female. Age 18.

THE PROBLEMS OF ADOLESCENCE

By A. SPENCER PATERSON, M.D., F.R.C.P.Ed.

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MENTAL health depends upon the individual's ability to make a satisfactory adjustment to life and that adjustment becomes more difficult if conditions are changing rapidly, as in the case of the adolescent. Within the period of a few years he or she has to change over successfully from the life of a child dependent upon parents to achieving independence and being psychologically capable of living the life of a mature man or woman. It is of great importance that everyone who has to deal with the adolescent, including the practitioner, should understand his problems and know the best way to guide him.

Knowledge of the behaviour and psychology of adolescence comes from various sources. The sociologist has gathered statistical information from observations and questionnaires. Mention may be made of the work of Barnes at Liverpool, Fletcher at Bristol, the researches of the National Association of Girls' Clubs and Mixed Clubs, as well as the vast amount of work that emerged from the White House Conference on Child Health in the U.S.A. in the 1930's. The case records of psycho-analysts and child psychiatrists, as well as the diaries of adolescents themselves, have described the characteristic intensity of feeling, the emotional instability and sense of insecurity. The anthropologist has also written of the rituals and ordeals which have helped the adolescent in primitive society to achieve emotional independence and self-reliance. There have also been historical studies of great men, many of whom, like Michelangelo, showed great precocity, whereas others, like Napoleon, Shakespeare, Sir Walter Scott and Gibbon, rather surprisingly failed to show any early promise of their subsequent greatness.

My clinical material includes a large number of boys from public schools and day schools, as well as the less well-to-do in two London psychiatric clinics. The girls treated have also come from widely different social classes.

PHYSICAL CHANGES

The age at which the girl first begins to menstruate depends upon race, climate and nutrition. In England the most usual age is fifteen, but in India it is thirteen, the extremes among otherwise normal women being nine and eighteen years of age.

The physiology of adolescence *in the female* may be described as follows:—The follicle-stimulating hormone of the pituitary acts on the ovary so as to produce oestrogen, a substance which causes the first menstrual flow. This signalizes the beginning of *puberty*. After a variable interval, prolactin

patients develop normally as boys, and after puberty begin to notice a retrogression in the size and shape of their genitalia, and a lack of development in their secondary sex characters, that is, the beard does not grow and the voice does not crack.

I have only operated on one case of this kind. His adrenal cortex gave a moderate fuchsine stain, and paradoxically, although his androgen excretion, low for a male, was slightly lowered by operation, he became more masculine. He put on two stone in weight, his voice deepened, he shaved more often, his genitalia doubled in size, and he grew an inch in height at the age of thirty-two, when it was found his epiphyses were still open. From a more or less neuter state he became more aggressive and assertive, and his sexuality asserted itself.

CONCLUSION

According to genetic direction, and later abnormal hormonal interference, it would seem on structural and physiological grounds that there are several grades, varying in detail, between what is generally recognized as the normal standards of male and female. There are a limited number of cases of virilism in which the psychological changes have tended to revert to normal parallel with those of the soma. On the other hand, the psyche does not necessarily follow the gonad, for there are marked differences in its manifestations among intersexual individuals, when the gonads are rudimentary, as among individuals who otherwise appear to be physically normal. Nor does the psyche necessarily accord with the upbringing of the individual. These are some of the exceptions in normal psychosexual stability. Modern medical opinion has been veering more and more towards psychosomatic study, and an increasing knowledge of endocrinology should tend to lessen the gap between clinical and psychological medicine.

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will have to unlearn completely at adolescence. It is also of the greatest importance that the average adolescent should have a clear picture in his mind of what he is aiming at in the subsequent ten years of his life. At present there is danger in the excessive study of abstract subjects with little or no relation to real life. For most boys the aim should be rather to achieve the mastery of a skilled occupation within a reasonable period and consequently to become financially independent and able to found a home. For many the possibility of travel, possibly in one of the Services, is welcomed in the period prior to settling down. Mental health depends not only upon past and present experiences, but also, as already mentioned, upon having a clear goal ahead. When these conditions are absent, there is much more likelihood of anxiety arising, which is linked to worry over sex.

Since adolescence intervenes between the life of the child and that of the adult, it is worth while to show in tabular form how the love life of the twelve-year-old contrasts with that of the fully grown individual of twenty-three years. For the young boy, Woman means Mother, but for the adult, Woman should mean Wife, potential or actual. Neurosis after adolescence frequently results from the man failing to separate clearly in his mind the two images of Mother and marriageable Woman. Even superficial investigation will often show that he is repressing sex towards his mother, whilst feeling inhibited and passive in relation to his wife.

Son-Mother Relationship
(Adolescent)

Mother of older generation
Mother shared with another (Father)
Passive attitude
Caressing causes no sexual feeling
Satisfaction from being loved rather than from loving
Relationship starts in infancy on a passionate basis and becomes less so during childhood

Girl-Father Relationship
(Adolescent)

Father of older generation
Father shared with another (Mother)
Attitude of dependence
Caressing causes no sexual feeling
Desire primarily to please Father by intellectual or artistic or business pursuits
Fear of sex as dangerous, disgusting or sinister

Man-Woman Relationship
(Adult)

Wife of same generation
Partner not shared until children come
Active comradeship
Caressing causes desire
Satisfaction from unselfish loving rather than being loved
Relationship starts as affection but becomes passionate, sensual, ending in physical union

Woman-Man Relationship
(Adult)

Husband of same generation
Partner not shared until children come
Attitude of comradeship
Caressing causes desire
Desire primarily to please husband by domesticity and maternity
Desire for sex to complete the marriage relationship

THE CHILD AND THE PARENT

With regard to the son-mother column we may consider what factors will make for emotional stability in the twelve-year-old. First he will be free from innate intellectual defect and from innate emotional instability (psychopathy), for there are some persons unstable from birth in whom education has little effect. The conditions giving the maximal chances for

from the pituitary excites the follicular investment of the ovum to become the luteal body and to make progesterone, which prepares the uterus for pregnancy. It is only when this whole process is completed that pregnancy is possible. This is the stage of *nubility*. The period between puberty and nubility is said by Ashley Montagu (1946) to be anything up to seven years and is called the period of adolescent sterility. On the basis largely of statistics compiled by Matthews Duncan in the last century, it is said that fecundity increases with each year from puberty up to the age of twenty-three, when *maturity*, i.e., full growth, is completed. In the years immediately after puberty, there is a somewhat increased liability to maternal and infantile mortality, which becomes minimal when maturity is reached.

In boys the first seminal emission is generally about the age of fifteen. Whereas in the boy the first orgasm occurs spontaneously, generally in sleep, the girl may remain unaroused indefinitely. An unduly early or late puberty often causes distress. Frequently the individual can be reassured if it is shown that normal members of his family had a similarly early or late puberty.

In boys the most rapid period of growth is at about fourteen and in girls at twelve. Increase in weight is most rapid in boys between nine and seventeen, in girls between nine and fifteen. In girls adolescent adiposity is often the cause of mental conflict, as well as unduly early or late puberty, as will be shown later. After puberty there is a great increase in the amount of muscle tissue. The heart enlarges, the blood pressure rises, and the basal metabolic rate increases by 25 per cent. The bones and muscles increase in a disproportionate manner, leading to the characteristic gawkiness and awkwardness which often lead to lack of confidence and a sense of frustration.

THE PSYCHOLOGY OF ADOLESCENCE

During this period the growing youth has gradually to free himself from dependence upon his parents. At the same time he is conscious of new urges towards a fuller experience of life. Unless these impulses can be directed to some extent into suitable channels, the adolescent will experience a sense of insecurity, frustration and anxiety. Under ideal conditions he will avoid this misfortune by various means. As he puts some distance between himself and his parents, so he seeks security elsewhere, chiefly in closer association with his contemporaries. Thus he often becomes unduly sensitive to public opinion. He dresses more carefully and is absurdly afraid of contravening the petty rules of his set or school. During this period the youth feels the need for a simple creed or philosophy that will give meaning to life. A rather surprising finding in various field researches into the interests of adolescent boys and girls, whether in England or America, among members of youth clubs as well as the class untouched by the social welfare authorities, is the great interest in religion. They are seeking a creed to guide them in the new world into which they are entering. It is therefore of great importance that children should not be taught doctrines that they

will have to unlearn completely at adolescence. It is also of the greatest importance that the average adolescent should have a clear picture in his mind of what he is aiming at in the subsequent ten years of his life. At present there is danger in the excessive study of abstract subjects with little or no relation to real life. For most boys the aim should be rather to achieve the mastery of a skilled occupation within a reasonable period and consequently to become financially independent and able to found a home. For many the possibility of travel, possibly in one of the Services, is welcomed in the period prior to settling down. Mental health depends not only upon past and present experiences, but also, as already mentioned, upon having a clear goal ahead. When these conditions are absent, there is much more likelihood of anxiety arising, which is linked to worry over sex.

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mental health in the child are somewhat as follows:—He will have had a happy relationship with his mother. He will have experienced the satisfaction of breast feeding in infancy. His sense of security will later have been strengthened by such physical expressions of affection as cuddling, or "Ride-a-cock-horse" and pick-a-backs from the father. The boy lives through an emotional drama which may be expressed thus:—"Mother loves me. Mother also loves Father. Therefore the more like Father I become, the more love I shall get from Mother". The attitude to the father may, however, be ambivalent. The child often feels "If Father were out of the way, I should get Mother all to myself". The attitude of love and respect for the father is greatly facilitated by the mother's point of view coinciding on most subjects with the father's. Again, if the father is generally respected in the neighbourhood, identification with the father is still more likely to occur. Harmony in the home and a sense of security are of the greatest importance for the child's mental health.

Sociologists have been able to demonstrate that when a parent has died young, or the child has been brought up in a badly run orphanage, or the child's father has been quarrelsome or a drunkard or a criminal, or if the child has been neglected, or the family has been socially isolated through having a different culture from their neighbours, then the chances of breakdown are increased. The worst cases of breakdown are those in which one or both parents have been grossly negligent, or on the other hand so over-possessive as to crush any attempt on the part of the child at self-expression. Cases of incest, even in better-class homes, are not so very uncommon. They occur generally in isolated districts.

The child will also be more stable if he has both a brother and sister about the same age as himself. The member of a big family has a greater sense of security, and when his parents are moody or difficult, he can turn for consolation to his playfellows. American studies have shown the great importance of children being able to confide in their parents, especially in receiving information on sexual matters.

Much the same may be said of the emotional development of girls. Although in early life the mother-figure is just as important as for boys, yet later on the relationship to the father is of course different. The pre-adolescent girl has already begun to idealize her father. As with the boy, her love has a physical component. She loves to climb on her father's knee or be carried by him. It is as if the girl has to graduate successfully before puberty in father-love if she is to qualify later for falling in love with a young man.

THE ADOLESCENT AND THE PARENT

The son-mother relationship must obviously undergo a radical change at puberty because of the development of the sexual urge. If the son persists in close intimacy with his mother, and if he continues to caress her unduly, then feelings of guilt may be aroused, with consequent anxiety symptoms. Normally, however, the adolescent tends to put some distance between his

parents and himself. Thereafter, until he reaches full maturity, there are various objects on which he may direct his love energy—the other members of his school or group, athletics, study and religion; or he may fall in love with the ideal woman as represented by some popular actress.

As already mentioned, the ability of the youth to fall in love with a girl depends upon his previous relationship to his mother. It is as if the youth on seeing the girl is reminded of what his mother had been like when he was a child and enjoyed her warm affection. He tends to put the girl on a pedestal and behave towards her as he would do to his mother. He admires her, as he has admired his mother, for her essentially feminine characteristics. It is only after a varying interval of time that affection gradually changes into passion.

THE PSYCHOPATHOLOGY OF ADOLESCENCE

The unstable adolescent may show either an excessive interest in sex or else a great fear of it. The former is generally associated with comparatively low intelligence. The most common problem is perhaps that of *masturbation*. Especially when the youth has not received instruction in sexual matters, a vicious circle may develop. In one case, for example:—

A fifteen-year-old boy's mother who was still exceptionally young, as she had married at seventeen, in summer would bathe and lie on the beach with him. Since she was at loggerheads with her husband, she made her son feel that he must protect her against his "cruel" father. The young mother in this way took on some of the characteristics of a lover and the youth, through repressing sexual ideas, felt an urge to masturbate with the fantasy that he was with a woman of his mother's age. This experience led to vague anxieties that something dreadful would happen to him, such as blindness or venereal disease. The youth found that masturbation itself relieved mental tension and so a vicious circle was set up.

Masturbation is more serious when it becomes as frequent as once a day. Not uncommonly it occurs oftener even than that. The habit is best treated by discussing the matter with the boy and by correcting the family situation which is giving rise to tension. Luminal, $\frac{1}{4}$ to $\frac{1}{2}$ grain (0.016 to 0.03 gm.) t.d.s., may help for a time.

In girls, *fear of sex* is commoner than over-indulgence. One such syndrome is when the girl becomes very shy about the physical changes at puberty, particularly prominence of the bust. The situation is common in girls who have a very early menarche. Masturbation often occurs, and during the act the figure of the girl's father or brother may enter her mind, and so she develops anxiety. She makes such efforts to repress sexual feeling that she becomes afraid of other bodily desires as well, including appetite for food. She loses weight and her menstruation ceases. She welcomes the disappearance of the signs of womanhood, which she fears. She can now love her father as she did before puberty without the danger of sex spoiling the relationship. Such a girl will be round-shouldered to hide the prominence of her breasts. She may shave the hair under the axillæ and in the pubic area. One such girl said that she always felt happier when wearing an overcoat in the house, if her father were about. Obsessional symptoms are common in such cases. The patient worries over food, which seems to lie heavily in

the stomach or block her intestine. She fears that meat will give her sexual desire. She becomes afraid of dirt and washes frequently to keep "pure". She shows a dislike for certain colours, red, black and yellow, which are connected in her mind with sex and death. Men appearing in dreams are often Japanese or negroid. When a girl thinks of men as being sinister and horrible, she is nearly always associating in her mind the idea of sex with the idea of Father. Her feelings are such as would be normal in a girl of twelve who was threatened with a sexual assault from an elderly man.

Often the ambivalent attitude to men leads to curious compromises. The girl derives satisfaction from substitute situations in which the real facts of sex or marriage are carried out in symbolic form. This explains much of the *invalidism* of young women. Thus a girl who fears the sexual act will nevertheless gloat in fantasy over the prospect of being laid on an operating table, while the surgeon takes a knife and thrusts it into her abdomen. This sexual symbolism gives emotional satisfaction, and accounts for the "abdominal woman" who used to continue her career until she was left with "no more viscera and no more money".

Youths with *syphilophobia* will frequently be found to have had sexual relations with a partner who is really a mother-figure in being older and already married. Obsessional ideas of disease then ensue, or the patient fears that his teeth or hair may come out.

Homosexuality often occurs in cases with little endocrine abnormality. It is frequently seen when the youth represses sex in regard to his mother. He feels less guilt in thinking of the male body than of the female, which for him signifies Mother. Girls also may become homosexual who are repressing sex towards their father. There appear to be no grounds, however, for thinking that separation of the sexes in schools is unsound. Sexual interest is less in these circumstances and greater opportunity is given for directing adolescent interest into other channels. The only danger is of sporadic outbreaks of homosexuality, generally in the form of mutual masturbation, which are apt to spread by suggestion, and these need to be treated energetically and at once by the authorities. Outbreaks of licence, however, are not confined to boarding schools. They may occur anywhere, including co-education schools.

The seeds of *delinquency* are usually laid in the years preceding adolescence, and it is not generally related to sex, except in the way of rebellion against parents and authority. It is commoner in those of low intelligence, and in psychopaths. It is more prevalent in areas where home conditions are bad. *Schizophrenia* and other psychoses, on the other hand, generally become manifest after adolescence, although the emotional conflicts which give rise to them may be already obvious in the teens. For this reason the correct treatment in adolescence of schizoid symptoms is by psychotherapy in the first instance, if the patient is accessible, for the most alarming schizophrenic symptoms can clear up rapidly when the family situation giving rise to them is corrected.

It appears that the dangers of adolescent *alcoholism* have been exaggerated, since sporadic outbreaks receive undue publicity (*Mass-Observation*: private communication). I have had several cases associated with very high wages in adolescence.

TREATMENT AND PREVENTION OF SEXUAL ABNORMALITIES

If a child is brought to the practitioner because he or she has shown unhealthy sexual behaviour, the best course is first to talk to the child sympathetically, when opportunity occurs, and explain the significance of sex in the life of the individual. Even more important is the removal of any unhappy atmosphere in the home which may be producing anxiety or tension in the child. It should be remembered that masturbation, or interest in the bodies of other children, or even mild incestuous thoughts are not uncommon in children. One study in the U.S.A. among good-class families showed that 40 per cent. of boys and 44 per cent. of girls remembered deriving pleasure from stimulating their genital organs before the age of eleven. Such stimulation is not generally carried through to completion. Ernest Jones talked of the pre-adolescent's initiatory pleasures and contrasted them with "completionary" or orgasmic pleasures after puberty. Fifty-one per cent. of men have associated the idea of inflicting pain with sexual desire and 30 per cent. of women with suffering pain (Ellis, 1933). School doctors have noticed that some masters show either excessive enjoyment in, or excessive horror at, caning, and even some boys in receiving it.

Masturbation or mild homosexual behaviour is therefore relatively unimportant if it is limited and transitory. It becomes more serious if it leads to worry and guilt, and if it is associated with mental tensions, with abnormal fantasy and with consequent feelings of guilt.

The prevention of sexual abnormality depends upon such factors as a feeling of security in early childhood. Before adolescence the child should have sexual instruction. The parents will already have been asked by the child at an early age "Where do babies come from?" and this should have been answered as truthfully as possible. The child should know that before birth the baby has reposed inside its mother's body.

Care should be taken that the child is never afraid of its own body. Threats of dreadful punishment for "self-abuse" are happily less frequent nowadays, but excessive talk about the dangers of disease often accentuates fears regarding the workings of the body. It is better if the child can welcome the pleasures to be derived from the body, such as physical exertion, eating, sleeping, and even of emptying the bladder and rectum. Any suggestion that the genitals are either disgusting or shameful should be avoided.

When explaining the fact of sex to a twelve-year-old girl, it should be remembered that for her, Man means Father. A description of the sexual act, if given crudely, has often caused a feeling of nausea or even vomiting. The girl already realizes that some day she may love someone about her own age just as much as she loves her father now. If then she loves a man as a

the stomach or block her intestine. She fears that meat will give her sexual desire. She becomes afraid of dirt and washes frequently to keep "pure". She shows a dislike for certain colours, red, black and yellow, which are connected in her mind with sex and death. Men appearing in dreams are often Japanese or negroid. When a girl thinks of men as being sinister and horrible, she is nearly always associating in her mind the idea of sex with the idea of Father. Her feelings are such as would be normal in a girl of twelve who was threatened with a sexual assault from an elderly man.

Often the ambivalent attitude to men leads to curious compromises. The girl derives satisfaction from substitute situations in which the real facts of sex or marriage are carried out in symbolic form. This explains much of the *invalidism* of young women. Thus a girl who fears the sexual act will nevertheless gloat in fantasy over the prospect of being laid on an operating table, while the surgeon takes a knife and thrusts it into her abdomen. This sexual symbolism gives emotional satisfaction, and accounts for the "abdominal woman" who used to continue her career until she was left with "no more viscera and no more money".

Youths with *syphilophobia* will frequently be found to have had sexual relations with a partner who is really a mother-figure in being older and already married. Obsessional ideas of disease then ensue, or the patient fears that his teeth or hair may come out.

Homosexuality often occurs in cases with little endocrine abnormality. It is frequently seen when the youth represses sex in regard to his mother. He feels less guilt in thinking of the male body than of the female, which for him signifies Mother. Girls also may become homosexual who are repressing sex towards their father. There appear to be no grounds, however, for thinking that separation of the sexes in schools is unsound. Sexual interest is less in these circumstances and greater opportunity is given for directing adolescent interest into other channels. The only danger is of sporadic outbreaks of homosexuality, generally in the form of mutual masturbation, which are apt to spread by suggestion, and these need to be treated energetically and at once by the authorities. Outbreaks of licence, however, are not confined to boarding schools. They may occur anywhere, including co-education schools.

The seeds of *delinquency* are usually laid in the years preceding adolescence, and it is not generally related to sex, except in the way of rebellion against parents and authority. It is commoner in those of low intelligence, and in psychopaths. It is more prevalent in areas where home conditions are bad. *Schizophrenia* and other psychoses, on the other hand, generally become manifest after adolescence, although the emotional conflicts which give rise to them may be already obvious in the teens. For this reason the correct treatment in adolescence of schizoid symptoms is by psychotherapy in the first instance, if the patient is accessible, for the most alarming schizophrenic symptoms can clear up rapidly when the family situation giving rise to them is corrected.

interest in religion, study and discussion groups; but both groups are equally interested in dancing (about 100 per cent.).

Loneliness is perhaps the chief bugbear in adolescence and practitioners should be acquainted with girls' clubs in their neighbourhood. Information can be obtained from the National Association of Girls' Clubs and Mixed Clubs, and also from the various pre-Service organizations.

Boys and girls are both much happier at this age if they can be taught some skilled occupation or hobby. Some American writers are perturbed that their youth are content with such modern "satisfiers" as radio, films, and motor cars, which require no study or perseverance in order to obtain satisfaction. There is a close analogy between the adolescent's attitude to work and to sex. This is best expressed by the idea that he has to kill his dragon in order to win the fair maid. Nowadays this means that he must master an occupation in order to found a new home. When he aims at this, the transition from the son-mother to the husband-wife attitude will be gradual. In facing up to his difficulties he can be greatly helped by adequate sexual instruction and by the best advice from schoolmasters or a vocational guidance clinic in the choice of an occupation which he can hope to master within a reasonable period. Vocational guidance can be given by the educational psychologist attached to a psychiatric clinic, or by application to the National Institute of Industrial Psychology, Aldwych House, Kingsway, London, W.C.2.

Appended is a list of some recent publications on adolescence, many of which have a good bibliography. A good book on sex education is "Sex, Friendship and Marriage", by K. C. and G. F. Barnes, published by Allen and Unwin (1938).

I should like to express my thanks to Miss Pearl Jephcot of "PEP" and to *Mass-Observation* for allowing me access to both published and unpublished material.

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husband, she will want to have a baby to love just as, to a lesser degree, she has loved her dolls or her pets. It can then be explained that, although it is difficult to imagine at her age, she will want some day to embrace and love her husband in such a way that he will put his seed in her so that a baby can grow inside her. Little girls are always delighted to see, for instance, a mother eat with her kittens, and when a child has experience of farm life, the attractive scene of a hen with her chicks, or a mare with her foal, will easily counterbalance any thoughts that the sexual act is anything horrible or disgusting.

Sexual instruction should also include the teaching of those qualities desirable in a partner and of the factors which are present to a significant degree in broken marriages. At present there is little awareness before marriage of the importance of mental and physical health in the spouse and in his or her family. It is a sound plan for children to study their family trees. They see there some branches that are flourishing and others that are withering. They can be inspired by hearing of those members who have led full and active lives, and discuss the causes of failure in those who have failed or died out. The adolescent is thus able to take an interest in moral values by which to guide his life.

Adolescent girls might well be encouraged to look after children more than they do. It may be that the higher birth rate among the poor is related partly to the greater inclination among them to care for babies in adolescence. A recent questionnaire shows that at fourteen years of age 50 to 75 per cent. of girls, according to class, like looking after young children, but at the age of nineteen only 12 per cent. of the better educated girls do so, and 40 per cent. of factory girls. It is doubtful if the lack of mother-love at this age is healthy. It may be caused by the subtle influence of unmarried school teachers or possibly by the girl's admiration of glamorous film stars who often make the courtesan idea of womanhood seem more attractive than that of woman in the home.*

The optimum age for marriage in woman is twenty-one. The problems of sex will not trouble her so much before that if she can find a normal outlet for adolescent interests. These vary somewhat according to class and intelligence. The factory girl is more interested in rather tawdry tales of love and high life, whether in book, magazine, film or play.

Factory girls (Jephcot, 1943) feel more dependent upon one particular girl, "my friend", and they are much concerned if they have not a boy friend between seventeen and nineteen, by which age they are often engaged. Miss Jephcot has some delightfully naïve accounts of the flirtation and bandinage, dancing and parties, as described in the diaries of working girls at this age. Office girls and grammar school girls, however, show more

*The words "genophilia" and "genophobia," which I introduced in 1943 to denote an attitude of mind that welcomes or shuns respectively the advent of children, are apparently now widely used. Genophobia in women might be lessened by the suggestion here.

In analysis of adult men Freud found that the foundations of their sex life and sex difficulties went back to adolescence, and back to childhood, especially to the two to five year-old period.

He found that there was a triangular situation which could not be described except by saying that the little boy was in love with his mother, and was in conflict with his father as a sexual rival. The sexual element was proved by the fact that it was not just in fantasy that these things were happening; there were physical accompaniments, erections, excitement phases with climax, murderous impulses, and a specific fear—fear of castration. This central theme was picked out and called the Œdipus complex, and it remains to-day a central fact, infinitely elaborated and modified, but inescapable. Psychology built on a hushing up of this central theme would have been doomed to failure, and therefore one cannot help being grateful to Freud for going ahead and stating what he repeatedly found, bearing the brunt of public reaction.

In using the term Œdipus complex Freud paid tribute to the intuitive understanding of childhood which is independent of psycho-analysis. The Œdipus myth really shows that what Freud wanted to describe has always been known.

A tremendous development of theory has taken place round the nucleus of the Œdipus complex, and much of the criticism of the idea would have been justified if the theory had been put forward as an artist's intuitive understanding of the whole of childhood sexuality or of psychology. But the concept was like a rung in a ladder of scientific procedure. As a concept it had the great merit that it dealt with both the physical and the imaginative. Here was a psychology in which the body and the mind were simply two aspects of one person, essentially related and not to be examined separately without loss of value.

If the central fact of the Œdipus complex is accepted it is immediately possible and desirable to examine the ways in which the concept is inadequate or inaccurate as a clue to child psychology.

The first objection comes from direct observation of little boys. Some boys do express in so many words and quite openly their in-love feeling for their mother and their wish to marry her, and even to give her children, and their consequent hate of father; but many do not express themselves in this way at all, and in fact seem to have more love feeling towards father than towards mother; and in any case brothers and sisters, nurses, and aunts and uncles, easily take the place of the parents. Direct observation does not confirm the degree of importance given to the Œdipus complex by the psycho-analyst. Nevertheless, the psycho-analyst must stick to his guns, because in analysis he regularly finds it, and regularly finds it to be important, and often he finds it severely repressed and only emerging after most careful and prolonged analysis. If in the observation of children their games are intimately examined, sexual themes and the Œdipus theme will be regularly found among all the others; but again, the intimate examination of children's games is difficult, and is best done in the course of analysis if it is carried out for research purposes.

The fact seems to be that the full Œdipus situation is but seldom enacted openly in real life. Intimations of it there certainly are, but the tremendously intense feelings associated with periods of instinctual excitement are largely

THE CHILD AND SEX

By D. W. WINNICOTT, F.R.C.P.

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It is a sign of the times that an article on the child and sex should appear in this symposium. The need at the present time is for accurate description. As so much is as yet unknown the student is recommended to carry out research in his own way, and if he must read instead of making observations let him read descriptions by many different writers, not looking to one or another as the purveyor of the truth. This article is not the retailing of a set of theories bought wholesale, it is an attempt to put in a few words one person's description of childhood sexuality, based on his training and experience as a pædiatrician and psycho-analyst. The subject is vast, and cannot be confined to the limits of an article without suffering distortion.

In considering any aspect of child psychology it is useful to remember that everyone has been a child. In each adult observer there is the whole memory of his infancy and childhood, both the fantasy and the reality, in so far as it was appreciated at the time. Much is forgotten but nothing is lost. What better example could direct attention to the vast resources of the unconscious!

In oneself, it is possible to sort out from the vast unconscious the repressed unconscious, and this will include some sexual elements. If special difficulty is found in allowing even for the possibility of childhood sexuality, it is better to turn one's attention to another subject. On the other hand, the observer who is reasonably free to find what is for observation, not having to guard too much (for personal reasons) against finding whatever is to be found, can choose from many different methods for objective study! The most fruitful, and therefore the one necessary for anyone who intends to make psychology his life work, is personal analysis, in which (if it is successful) he not only loses the active repressions, but also discovers through memory, and by reliving, the feelings and essential conflicts of his own early life.

THE CONTRIBUTION OF PSYCHO-ANALYSIS

Freud, who was responsible for drawing attention to the importance of childhood sexuality, arrived at his conclusions through the analysis of adults. The analyst has a unique experience every time he conducts a successful analysis, in that he sees unfolding before him the patient's childhood and infancy as it appeared to the patient. He has the repeated experience of getting to see the natural history of a psychological disorder, with all the interweaving of the psychological and the physical, of the personal and the environmental, of the factual and the imagined, of what has been conscious to the patient and what has been under repression.

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in the child's unconscious or quickly become repressed, being none the less real for all that; temper attacks and the common nightmares that occur normally in the three-year old cannot be understood except in terms of firm attachment to persons, with periodic rising instinctual tension, and acute exacerbation of conflict in the mind arising out of hate and fear clashing with love.

A modification of the original idea (one made by Freud himself) is that the very intense and highly coloured sex situations that an adult in analysis recovers from his own childhood are not necessarily episodes that could have been observed as such by his parents, but nevertheless are true reconstructions based on unconscious feelings and ideas belonging to childhood.

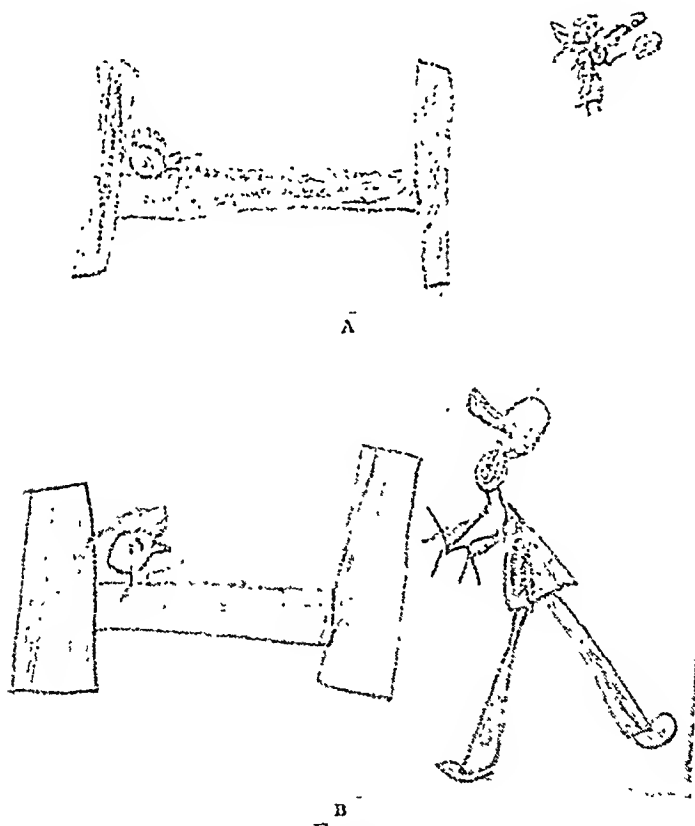


FIG. 1

An example of this is seen in the drawing (fig. 1, A and B) done by a girl of six years who was brought to an out-patient department because of nightmares. She drew a dream in which her father came at her "pretending to be a bad (sexual) man". What happened really was that her father for a practical joke blackened the children's faces when they were asleep. He was a good father and the home was an excellent

one. The child would remember the episode, in her analysis in later life, as a black man, reminding her of her father, coming towards her in bed, and exciting her sexually and so frightening her. This in fact did not happen, but it was the equivalent of the actual event in terms of the child's psychic reality.

This brings up another point, what about little girls? The first assumption was that they fall in love with their fathers, and hate and fear their mothers. Here again is a truth, and here again the main part is likely to be unconscious, not something that the little girl would admit, except in very special circumstances of trust.

Many girls, however, do not get so far in their emotional development as to become attached to father, and to take the very great risks inherent in being in conflict with mother. Alternatively, an attachment to father is formed, but regression (as it is called) occurs back from a relation to father weakly acquired. The risks inherent in conflict with mother are great indeed, for with the idea of mother (in unconscious fantasy) is associated the idea of loving care, good food, the stability of the earth, and the world in general; and a conflict with mother necessarily involves a feeling of insecurity and dreaming of the ground opening, or worse. The little girl, then, has a special problem, if only because when she comes to love her father her rivalry is with her mother who is her first love in a more primitive way.

The little girl, like the little boy, has physical sex feelings appropriate to the type of fantasy. It might usefully be said that whereas a boy at the height of his sex wave (at the toddler age and at puberty) is especially afraid of castration, in a girl at a corresponding stage the trouble is a conflict in her relation to the physical world brought about by her rivalry with her mother, who was originally for the child the physical world itself. At the same time the little girl suffers fears in regard to her body, fears of castration like those of a boy, and fears that her body will be attacked by hostile mother figures, in retaliation for her wish to steal her mother's babies, and much else.

BISEXUALITY

This description is obviously defective in respect of bisexuality. At the same time in a child's life that the ordinary heterosexual relationship is vitally important the homosexual relationship always exists, and can be relatively more important than the other. Another way of putting this is to say that a child normally becomes identified with each parent, but at any one moment principally with one parent; and this parent need not be the one of the child's sex. In all cases there is a capacity for identification with the parent of the other sex, so that in the sum-total of a child's fantasy life (if search be made) there can be found the whole range of relationships, regardless of the actual sex of the child. It is convenient, naturally, when the main identification is with the parent of the same sex, but in psychiatric examination of a child it would be wrong to jump to a diagnosis of abnormality if the finding is that the child is mainly wanting to be like the parent of the other sex. Such can be the child's natural adaptation to special circumstances. In certain cases

in the child's unconscious or quickly become repressed, being none the less real for all that; temper attacks and the common nightmares that occur normally in the three-year old cannot be understood except in terms of firm attachment to persons, with periodic rising instinctual tension, and acute exacerbation of conflict in the mind arising out of hate and fear clashing with love.

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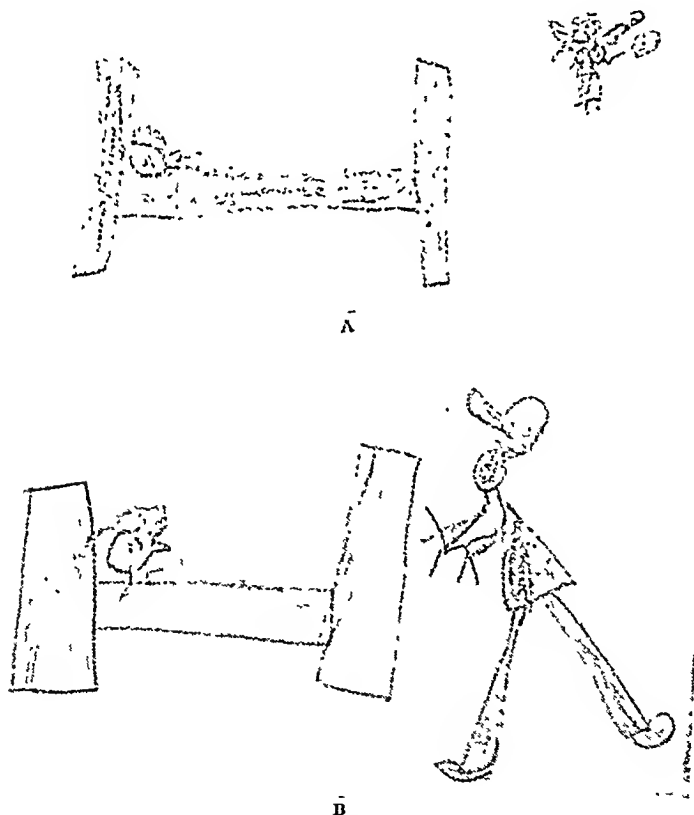


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is concerned with sexual ideas and symbolism, and this is not saying that children who are playing are always sexually excited. Children, when playing, may get excited in a general way, and periodically the excitement can become localized and therefore obviously sexual, or urinary, or greedy, or something else based on the capacity of tissues for excitement. Excitement calls for climax. The obvious way out for a child is the game with climax, in which excitement leads to something, "a chopper to chop off your head", a forfeit, a prize, someone is caught or killed, someone has won, and so on.

Innumerable examples could be given of sex fantasy acted out, but not necessarily accompanied by bodily excitement. It is well known that a big proportion of little girls and some little boys like to play with dolls and to act towards the dolls as mothers do towards babies. They not only do as mother did, thereby complimenting her, but also they do as mother ought to have done, thereby reproaching her. The identification with a mother can be very complete and detailed. As in all these matters, there is a physical side of the experience along with the fantasy that is being acted out, and pains in the belly and sickness can be due to the mother game. Boys as well as girls stick their bellies out for fun, imitating pregnant women, and it is not very uncommon for a child to be brought to the doctor for enlarged belly when the trouble is a secret imitation of a pregnant woman, whose condition is supposed to have been unnoticed. As a matter of fact children are always looking out for swellings, and however successfully sex information is withheld from them they are unlikely to miss spotting a pregnancy. They may, however, keep the information in a compartment of the mind, unassimilated, because of the parents' prudery.

Children the world over have a game called "Fathers and Mothers", which becomes enriched by an infinite quantity of imaginative material, and the pattern each group of children evolves tells a good deal about the children, and especially about the dominant personality in the group.

Children do often act out the adult type of sexual relationship in relation to each other, but usually this is done secretly and is not therefore recorded by people who are making deliberate observations. Naturally, children easily feel guilty in so playing and also they cannot help being affected by the fact that such play comes under a social ban. It could not be said that these sexual incidents are harmful, but if they are accompanied by a feeling of severe guilt and become repressed, unavailable to the child's consciousness, then harm has been done. This harm can be undone by the recovery of the memory of the incident, and it can sometimes be said that such an incident easily remembered has its value as a stepping-stone in the long and difficult journey from immaturity to maturity.

There are many other sex games which are related less directly to sexual fantasy. No claim is made here that children think only of sex: however, a sex-inhibited child is a poor companion, and is impoverished like a sex-inhibited adult.

ROOTS OF SEX

The subject of childhood sexuality simply does not allow itself to be confined rigidly to the excitement of sex organs and the fantasy that belongs to such excitement. In studying childhood sexuality it is possible to see the way in which the more specific excitement is built up out of bodily excitements of

cross-identifications can, of course, be a basis for later homosexual tendencies of abnormal quality. In the "latency" period, between the first sexual period and adolescence, cross-identifications are especially important.

BASIS FOR ADULT MENTAL HEALTH

A principle is being taken for granted in this description which perhaps ought to be deliberately formulated. The basis of sexual health is laid down in childhood, and in the reduplication of early childhood development that takes place at puberty. The corollary is equally true, that sexual aberrations and abnormalities of adult life are laid down in early childhood. Further, the basis of the whole of mental health is laid in early childhood and in infancy—and so is the concern of the pædiatrician if he only knew it; but this is an extension of the subject beyond the scope of this article.

SEX IN ORDINARY PLAY

Ordinary child's play is greatly enriched by sexual ideas and sexual symbolism, and if there is strong sex-inhibition a play-inhibition follows. There is a possible confusion here arising out of the lack of clear definition of sex play. Sexual excitement is one thing, and the acting out of sex fantasy is another. Sex play with bodily excitement is a special case, and in childhood the outcome is liable to be difficult. The climax or detumescence is often represented more by the aggressive outburst that follows frustration than by a true relief of instinctual tension such as can be obtained by an older person after the onset of puberty. In sleep the dream life rises at times to excited states, and at the climax the body commonly finds some substitute for full sexual orgasm, such as wetting, or waking in nightmare. Sexual orgasm is not likely to be as satisfactory as such in the little boy as it can be after puberty, with emission added; perhaps it is more easily got by the little girl who has nothing to add as she matures, except being penetrated. These times of recurring instinctual tension must be expected in childhood, and substitute climaxes have to be provided—notably meals—but also parties, outings, special moments.

Parents know well enough that they often have to step in and induce a climax by a show of strength, even a smack producing tears. Mercifully, children get tired in the end, and go to bed and to sleep. Even so, the delayed climax may disturb the calm of night, as the child wakes in a night-terror, and mother or father are needed immediately if the child is to regain a relation to external reality, and the relief that comes from an appreciation of what is stable in the real world.

All physical excitements have ideational accompaniments, or (the other way round) ideas are themselves the accompaniment of physical experience. Mental pleasure, as well as gratification and relief from tension, comes from the common playing of childhood which is the acting out of fantasy apart from physical excitement. Much of the normal and healthy play of childhood

is concerned with sexual ideas and symbolism, and this is not saying that children who are playing are always sexually excited. Children, when playing, may get excited in a general way, and periodically the excitement can become localized and therefore obviously sexual, or urinary, or greedy, or something else based on the capacity of tissues for excitement. Excitement calls for climax. The obvious way out for a child is the game with climax, in which excitement leads to something, "a chopper to chop off your head", a forfeit, a prize, someone is caught or killed, someone has won, and so on.

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ROOTS OF SEX

The subject of childhood sexuality simply does not allow itself to be confined rigidly to the excitement of sex organs and the fantasy that belongs to such excitement. In studying childhood sexuality it is possible to see the way in which the more specific excitement is built up out of bodily excitements of

all types, reaching forward to the more mature feelings and ideas easily recognized as sexual; the more mature develops from the more primitive, the sexual from (for instance) the cannibalistic instinctual urges.

It can be said that a capacity for sexual excitement, in either sex, is present from birth, but the primary capacity of parts of the body for excitement have limited significance until the child's personality has become integrated, and it can be said that it is the child as a whole person who is excited in that specific way. As the infant develops, the sexual type of excitement gradually acquires importance relative to the other types of excitement (urethral, anal, skin, oral), and at the age of three, four or five years (as also at puberty) becomes capable, in healthy development, of dominating over other functions in appropriate circumstances.

This is another way of saying that all the innumerable accompaniments of sex in adult behaviour derive from early childhood, and it would be an abnormality and an impoverishment if an adult could not naturally and unselfconsciously employ all manner of infantile or "pregenital" techniques in sex play. Nevertheless, the compulsion to employ a pregenital *instead of* genital technique in sex experience constitutes perversion, and has its origin in a hold-up of emotional development in early childhood. In analysis of a case of perversion there can always be found both a fear in regard to forward development to mature sex, and a special capacity to get satisfaction in more primitive ways. Sometimes there are actual experiences enticing the child back to infantile types of experience (as when an infant has become excited at introduction of a suppository, or has reacted with excitement to being tightly bound by a nurse, and so on).

The story of the building up of the mature child from the immature infant is long and complex, also it is vitally important for the understanding of the psychology of the adult human being. To develop naturally, the infant and child need an absolutely stable environment.

Roots of female sexuality.—The roots of a little girl's sexuality go right down to her early greedy feelings in relation to her mother. There is a gradation from her hungry attack on her mother's body to the mature wish to be like mother. Her love of her father can be as much determined by his being stolen (so to speak) from mother as by his actually being especially loving to her; indeed, when a father is away over the period of a girl's infancy so that she does not really know him, her choice of him as a love object may be entirely due to the fact that he is mother's man. For these reasons there is a close association between stealing and sex desire, and the wish to have a baby.

The consequence of this is that when a woman becomes pregnant and has a baby she has to be able to deal with the feeling, somewhere in her, that the baby was stolen from inside her mother's body. If she cannot feel this, as well as knowing the facts, she loses something of the gratification that pregnancy can bring, and she loses much of the special joy of presenting

her own mother with a grandchild. This idea of theft can cause guilt after conception, and can cause miscarriage.

It is especially important to know of this guilt potential in the practical matter of management of the period immediately after child-birth. A mother is at that time very sensitive to the type of woman in charge of her and her baby. She needs help, but because of these ideas derived from early childhood she can only believe in a very friendly or a very hostile mother-figure at that time; and a primipara, even a healthy minded one, is very liable to feel persecuted by her nurse. The reason for this and other phenomena characteristic of the state of motherhood must be sought in the early roots of the little girl's relation to mother, including her primitive wish to gain womanliness by tearing it from her mother's body.

NATURE OF PSYCHIATRIC ILLNESS

Here is another principle that is worth formulating: in psychiatry every abnormality is a disturbance of emotional development. In treatment, a cure is brought about by enabling the patient's emotional development to go ahead where it was held up. To get to this point where it is held up the patient must always get back to early childhood or infancy, and this fact ought to be of extreme importance to the pædiatrician.

Psychosomatic disorders.—There is one way in which childhood sexuality is of direct importance to the practising pædiatrician; that is, the transformation of sexual excitement into symptoms and physiological changes that resemble the symptoms and changes brought about by physical diseases. These symptoms, which are called psychosomatic, are exceedingly common in all medical practice, and it is from them that the general practitioner weeds out the occasional textbook diseases for the expert attention of the specialist.

These psychosomatic disorders are not seasonal or epidemic; in any one child, however, they show a periodicity, albeit an irregular one. This periodicity is simply an indication of the underlying recurring instinct tension.

Partly because of internal reasons and partly because of environmental exciting factors, every now and again a child becomes an excitable being. The phrase "all dressed up and nowhere to go" might have been designed to describe this state. A study of what happens to this excitement is almost a study of childhood, and of the child's problem: how to retain the capacity for eagerness and excitement without experiencing too much painful frustration through lack of satisfactory climax. The main methods by which children cope with this difficulty are:—

(a) Loss of capacity for eagerness; but this carries with it a loss of sense of body, and much else that is disadvantageous.

(b) Employment of some sort of reliable climax, either eating or drinking or masturbation, or excited urination or defæcation, or a temper tantrum, or a fight.

(c) The perversion of the body functions in a way that enables a spurious climax to be reached—vomiting and diarrhœa, a bilious attack, exaggeration of a catarrhal infection, complaint of aches and pains that would otherwise be unnoticed.

(d) A general muddle of all these, with a period of unwellness, perhaps with

headache and loss of appetite, a period of general irritability, or a tendency of certain tissues to be excitable (for instance, all the phenomena clumped together, in present-day nomenclature, under the word "allergic").

(c) An organization of excitement into a chronic "nerviness" which may remain constant over a long period, ("common anxious restlessness", perhaps the most common disorder of child out-patients).

The bodily symptoms and changes related to emotional states and disorders of emotional development form a large and important subject for the attention of the pædiatrician.

MASTURBATION

In a description of childhood sexuality, mention must be made of masturbation. Here again is a vast subject for study. Masturbation is either normal or healthy or else it is a symptom of a disorder of emotional development. Compulsive masturbation, just like compulsive thigh-rubbing, nail-biting, rocking, head-banging, head swaying or rolling, thumb-sucking, and the like, is evidence of anxiety of one kind or another. If severely compulsive it is being employed by the child in his effort to deal with anxiety of more primitive or psychotic type, such as fear of disintegration of personality, or fear of loss of sense of the body, or fear of loss of touch with external reality.

Perhaps the most common disorder of masturbation is its suppression, or its disappearance from a child's repertoire of self-managed defences against intolerable anxiety or sense of deprivation or loss. An infant starts life with the capacity to handle his mouth and to suck his fist, and indeed he needs this ability to comfort himself. He needs his hand to his mouth even if he has what is best for him, a right to his mother's breast when he feels hungry. How much more does he need it when he is regimented. All through infancy he needs whatever satisfaction he can get from his body, from fist-sucking, from passing water, from defæcation, and from holding his penis.

Ordinary masturbation is no more than an employment of natural resources for satisfaction as an insurance against frustration and consequent anger, hate and fear. Compulsive masturbation simply implies that the underlying anxieties to be dealt with are excessive. Perhaps the infant needs feeding at shorter intervals, or he needs more mothering; or he needs to be able to know that someone is always near at hand, or his mother is so anxious that she ought to allow him more quiet lying in a pram, and less contact with her. It is logical to try to deal with the underlying anxiety when masturbation is a symptom, but illogical to try and stop the masturbation. It must be recognized, however, that in rare cases compulsive masturbation is continuous and is so exhausting that it has to be stopped by repressive measures, simply in order to give the child some relief from his or her own symptom. When relief is obtained in this way new difficulties must appear

in the child's adolescence, but the need for immediate relief can be so great that troubles a few years ahead seem relatively unimportant.

When all goes well masturbation accompanying sexual ideas happens without being much noticed, or is only recognized through a child's breathing changes, or because of a sweating head. Trouble follows, however, when there is a combination of compulsion to masturbate with inhibition of sex feeling. In this case the child becomes exhausted by his efforts to produce the satisfaction and climax that he cannot easily attain. To give up involves a loss of sense of reality, or loss of the sense of value. To persist, however, leads eventually to physical debility, and the notorious rings under the eyes which indicate conflict, and which are commonly ascribed wrongly to masturbation itself. Sometimes it is kind to help a child out of this impasse by paternal strictness.

IMPORTANCE OF THE GENITALIA

Psycho-analytic study of children (as of adults) shows that the male genital is valued much more highly in the unconscious than would appear from direct observation, although of course many children do express their interest in the penis openly, if they are allowed. Little boys value their genitalia just as they value their toes and other parts of their bodies, but in so far as they experience sexual excitement they know the penis has special importance. Erection associated with love feelings determines castration fears. The penis excitement of a boy infant has its fantasy parallel, and a great deal depends upon the type of fantasy that goes with the early erections.

The onset of genital excitement is variable. Genital excitement may be almost absent in early infancy or, alternatively, erections may be almost constantly present from birth. Naturally, no good can come from early awakening of penis excitement. It seems likely that the dressings after circumcision frequently stimulate erections and cause an unnecessary association of erection with pain, this being one of several reasons why circumcision should almost never be performed (except on religious grounds). It is convenient when genital excitement is not a marked feature before the other parts of the body have become established as having an importance of their own, and certainly any artificial stimulation of the genitals of infants (either by post-operative procedure or by the desire of uneducated nannies to produce soothing sleep) is a complication; and the process of the child's emotional development is complex enough inherently.

To the little girl the visible and palpable boy's genitalia (scrotum included) are very liable to become an object of envy, but especially in respect of her attachment to her mother developing along identification-with-man lines. However, the matter is not as simple as this, and no doubt a large proportion of little girls are quite contented to have their own more hidden but just as important genitalia, and to allow boys their more vulnerable male appendages. In time a girl learns to evaluate the breasts. These become almost as important to her as the penis is to the boy, and when a girl knows she has the capacity, which a boy has not, to carry and produce as well as

to feed babies, she knows she has nothing to envy. Nevertheless, she must envy the boy if she is driven by anxiety back from ordinary heterosexual development to what is called a fixation to her mother, or a mother-figure, with a consequent need to be like a man. Naturally, if a little girl is not allowed or does not allow herself to know she has an exciting and important part of her body in her genitalia, or is not allowed to refer to it, her tendency to penis envy is increased.

Clitoris excitement is closely associated with urinary erotism, which lends itself more to the kind of fantasy that goes with identification with the male. Through clitoris erotism the girl knows what it would feel like to be a boy with penis erotism. Similarly, a boy can experience in the skin of the perineum feelings that correspond to those that belong to the vulva of a girl.

This is quite separate from the anal erotism which is normally a feature in either sex, and provides, along with oral, urethral, muscle and skin erotism, an early root of sex.

There is no lack of evidence in sociology and folk lore and in the myths and legends of primitive peoples of the paternal or ancestral penis, worshipped in symbolic form and exerting immense influence. In the modern home these things are as important as ever, although they are hidden; but their importance shows up when a child's home breaks up, and he suddenly loses the symbols on which he had come to rely, so that he is at sea without a compass, and he is in distress.

CONCLUSION

A child is so much more than sex. In the same way your favourite flower is so much more than water; yet a botanist would fail in his job if in describing a plant he forgot to mention water, of which it is chiefly composed. In psychology there really has been a danger that the sex part of child life might have been left out because of the taboo on childhood sexuality.

The sexual instinct gathers together in childhood, in a highly complex way, out of all its components, and exists as something that enriches and complicates the whole life of the healthy child. Many of the fears of childhood are associated with sexual ideas and excitements, and with the consequent conscious and unconscious mental conflicts. Difficulties of the sexual life of the child account for many psychosomatic disorders, especially those of recurring type.

The basis for adolescent and adult sexuality is laid down in childhood, and also the roots of all sexual perversions and difficulties.

The prevention of adult sexual disorders, as well as of all but the purely hereditary aspects of mental and psychosomatic illness, is in the province of the pædiatrician, that is, if the pædiatrician can bring himself to study psychology in the way that he studies physiology and embryology and allied physical sciences.

PROSTITUTION

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PROSTITUTION has been defined as promiscuous unchastity for gain. Whether practised by women or men, adolescents or adults, the gain is essentially financial, the client unselected, and emotional, as distinct from physiological, satisfaction is wanting. It should be differentiated from concubinage, the cohabitation of a man and a woman who are not legally married; from adultery, the voluntary sexual intercourse of a married person with a member of the opposite sex whether married or unmarried; and from other irregular sexual relations motivated by passion.

The Biblical account of Tamar, who "put her widow's garments off from her, and covered her with a vail, and wrapped herself, and sat in an open space", and was consequently mistaken for a prostitute by her father-in-law Judah, is a clear indication that prostitution was recognized in the social life of Canaan at that time.

LEGAL ASPECTS

There is no registration or periodical examination of prostitutes in Great Britain, and brothels are not licensed. Under different Acts in England and Wales offences related to prostitution fall into two categories:—

(1) *Offences by prostitutes.*—(a) Common prostitute behaving in a riotous and indecent manner in a public place (Vagrancy Act, 1824, sect. 3, and sect. 4, so far as it relates to this offence when committed by a person who has been convicted as an idle and disorderly person); (b) common prostitute or night-walker loitering and importuning passengers for the purpose of prostitution [Town Police Clauses Act, 1847, sect. 28(16)]; (c) common prostitute or night-walker loitering, or being in any public place for the purpose of prostitution or soliciting to the annoyance of passengers, etc. [Metropolitan Police Act, 1839, sect. 54(11)]; (d) offences under all similar provisions in Local Acts.

(2) *Persons aiding, abetting, counselling, or procuring the commission of offences enumerated above.*—From time to time legislation relating to prostitution has been introduced for special reasons. The Mental Deficiency Act, 1913, made punishable the procurement of, or attempts to procure, women and girls who are mentally defective (sect. 56, 1.b.c.) The Children and Young Persons Act, 1933, made it a penal offence to encourage the prostitution of a girl under the age of sixteen [sect. 2 (1)] or to allow a child or young person under the age of sixteen to reside in or frequent a brothel [sect. 3(1)].

to feed babies, she knows she has nothing to envy. Nevertheless, she must envy the boy if she is driven by anxiety back from ordinary heterosexual development to what is called a fixation to her mother, or a mother-figure, with a consequent need to be like a man. Naturally, if a little girl is not allowed or does not allow herself to know she has an exciting and important part of her body in her genitalia, or is not allowed to refer to it, her tendency to penis envy is increased.

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how to achieve this object, and, in particular, the view was expressed that the system of annual reports from Governments should be continued.

STATISTICAL DATA

The annual average number of persons dealt with for prostitution at courts of summary jurisdiction in England and Wales during the period 1910-14 was 10,682. In 1928 the number had fallen to 2,992. From 1931 there was a gradual rise, except in 1937, and in 1938 offences by prostitutes numbered 3,192. During the period 1929-38 the annual average of persons found guilty of offences aiding and abetting prostitutes was 118, of living on the earnings of prostitution 176, and of brothel-keeping 210.

The official figures give no indication of the size of the problem. The same person may commit more than one of the above offences during a year; the arrests tend to reflect the state of public opinion at the time, and may be influenced by periods of economic depression and police practice. It should also be noted that the prostitute's client is an accomplice, and a stranger who is annoyed by solicitation may be unwilling to lodge a complaint with the police. Apart from official figures there is general agreement among social workers, voluntary social agencies, and those connected with the administration of schemes for combating venereal diseases, as well as among some other observers, that the number of professional prostitutes has decreased in recent years, whereas non-professional sexual immorality has increased.

The figures relating to procuration, etc., must also be regarded as understating the facts, since women are usually unwilling to reveal the identity of those who aid and abet them and the nature of their relations with the men who live on their earnings, unless duplicity or gross wanton behaviour has outraged them.

SOCIAL ASPECTS

FEMALE PROSTITUTION.—Promiscuity among women may be conveniently assessed from the points of view of financial interest, personal selection, and emotional satisfaction. The woman who eschews material reward and selects a partner to satisfy her sexual desires and emotional needs may indulge in promiscuity, like the prostitute, occasionally or habitually. But she is not a prostitute according to the above definition. Neither is she censured or despised to the same extent as the prostitute, who has been condemned throughout the centuries, not only on religious, ethical and æsthetic grounds, but because she violates the fundamental possessiveness of others, and tends to disrupt important factors in social life. Even flirts of either sex who have no desire to possess or belong to another are often condemned for their insincerity, although their sexual urge may be weak or undeveloped. Flirtatiousness may be looked upon as an expression of emotional immaturity, and is opposed to the natural desire of women to

The legal protection of persons in institutions has been taken further in Switzerland. Article 193 of the Swiss Federal Criminal Code of 1937 authorizes the punishment of "Whoever copulates with a person in the care of a hospital, of an institution by official order, (or) with a prisoner, an arrested or accused person". It is also an offence to commit any other immoral act with such a person.

Special precautions have been adopted in war time to check the spread of venereal diseases among the Fighting Services. In World War I, D.O.R.A. 40.D, was introduced to bring under treatment girls and women who were responsible for much inefficiency through infection of Service men. It proved unsatisfactory in working. On November 5, 1942, Defence Regulation 33B, provided broadly, that any person who had been reported by one or more medical practitioners who are specialists in venereal disease as being suspected of having infected two or more of their patients may be compelled to undergo examination by a special practitioner and to remain under his direction in respect of examination and any necessary treatment until pronounced free from venereal disease "in a communicable form".

Before the League of Nations was established, international action on traffic in women had been limited to the making of two international instruments, an Agreement of 1904, which provided for the setting up of Central Authorities in each of the contracting States and for other minor administrative measures, and the Convention of 1910, under which contracting States undertook to punish the procuration of women under the age of twenty.

One of the first steps taken by the League was to convene an International Conference in 1921 to make a new Convention raising the age of protection to twenty-one for persons of either sex. At the same time, an Advisory Committee on Traffic in Women and Children was set up by the Council of the League. This Advisory Committee instituted a system of annual reports from Governments on the extent of the traffic and the measures being taken to deal with it. In 1937, a draft Convention was prepared, designed to secure the prosecution and punishment of any person keeping or managing a brothel or exploiting the prostitution of another person. Such a Convention would have greatly strengthened the international measures hitherto undertaken but, unfortunately, further work on this draft was brought to an end by the war.

In a Report submitted by the Temporary Social Commission to the Second Session of the Economic and Social Council of the United Nations (dated June 12, 1946) the Temporary Commission states that, as regards traffic in women and children, it is "satisfied that the functions undertaken by the League should be assumed by the United Nations, and that all measures designed to prevent the traffic in women should be actively pursued". It therefore recommended that the subject be referred to the Permanent Social Commission (which has since been set up) to consider

bauchery, often temporarily becomes a very different person to her former self. So much so that undue stress may be laid upon the influences pertaining to her occupation when at liberty, and insufficient regard may be given to the constitutional factor which prevents her from selecting and securing some other means of livelihood when an opportunity to do so arises.

The change in moral and social values to-day must be taken into account. An adolescent girl discussing her future recently, stated, quite dispassionately, that she thought she would be a prostitute. She seemed inclined to reconsider the matter on being reminded that her rather delicate health would probably give way as a result of being out late at night in all weathers looking for customers.

The ease with which some girls take up a life of prostitution, and the tenacity which prevents them from giving it up also suggest that prostitution usually depends upon personality rather than personality upon prostitution. It is true that we find the personality of, say, a professional or business man is affected by his occupation in greater or less degree, and it would be somewhat astonishing if the experience, aims and habits of the prostitute were not sooner or later reflected to some extent in her character. But there seems to be little doubt that the majority of women become prostitutes because their character traits override other considerations.

To many the prostitute appears to be a lazy, shiftless, avaricious, dishonest, untruthful, selfish and faithless woman. But some are charitable, kindly, sympathetic and affectionate. Although ostracized by society the prostitute lives in a small social group with its own social standards. If a man lives on her immoral earnings and is utterly despicable, he yet may be the only person for whom she has any tender feeling. She dissociates him from the men who are her customers, and in his company can relax and be her natural self, and throw aside the arts and devices of her calling. He frequently acts as her champion in a dispute and her protector in a scene of violence. He forms a bridge which unites what she is with what she might have been. He supports her artificial self-reliance and the real weakness of her social position. He satisfies her inherent desire for ownership and, although he may exploit her cruelly and callously, satisfies her masochistic cravings. Hence, it may be particularly difficult to influence her so long as her masochistic submissions produce emotional gratification.

The dangers involved.—Here it may be noted that the prostitute is particularly liable to be inveigled into a situation of great physical peril. Of the last 114 women who were murdered by men psychiatrically examined by me, 15 were prostitutes. The murder frequently occurred when the woman was unclothed and was usually a prelude to robbery. She was sometimes killed when asleep, and the defenceless position of a nude woman lying on a bed, even if awake, makes her particularly vulnerable, and escape difficult, unless she is exceptionally resourceful and has an unusual degree of awareness.

attain security in their sexual life and the permanent companionship afforded by marriage. Moreover, the institution of marriage is accepted to some extent by men as a method of protecting women against sexual brigandage.

Environmental factors.—The factors which determine a woman to adopt this form of traditional behaviour are environmental and constitutional. Among the former may be noted maladjustment at home, economic stress, lack of religious education and religious enthusiasm, promiscuous and indecent living due to overcrowding, the demoralization of young people by their elders, the example of luxury, self-indulgence, loose thinking, loose habits and customs in certain classes of society, corrupting amusements and literature, seduction by profligate men and women, and alcoholism.

Discussing the biological aspects of prostitution, Sybil N. Rolfe (1937) considers that poverty is not a major factor. She refers to the British figures of Burt (1926) and to Schneider's (1926) inquiry, which go to show that girls are found practising prostitution who have come from all kinds of homes, varying from well-to-do to the very poor. Kemp (1936) surveyed the immediate causes of prostitution in 530 women in Copenhagen: poverty or dire economic need was found in 24.2 per cent.; fondness of dancing and restaurant life in 22.8 per cent.; influence of sisters or women friends in 13.2 per cent.; influence of pimp in 8.3 per cent.; tendency to vagabondage in 3.4 per cent., and other causes or cause unknown in 28.1 per cent.

The constitutional factors of prostitution have been considered by Gladys M. Hall (1933). She believes that there are at least three classes of girls or women possessing tendencies which make them particularly liable to turn to prostitution in the absence of strong social or personal inhibition:—(a) Individuals possessing a certain combination of characteristics which appear to make promiscuity probable unless some counter-influence appears; (b) individuals temporarily possessed of precocious or abnormally developed sex impulses; and (c) individuals who, because of inheritance or glandular development, are over-sexed.

It is sometimes suggested that the personality of the prostitute is a result of her occupation rather than a reason for her selecting it as a mode of life. The first departure from chastity appears usually to be emotional, selective, and irrespective of financial gain. But those who have had many prostitutes under medical observation for substantial periods may agree that the underlying constitution of the majority is largely accountable for their commercialized promiscuity. Indeed, it is difficult to believe otherwise, having regard to the fact that many of them are either subnormal, or feeble-minded persons, psychic inferiors, ethical aberrant personalities, aggressive ego-centric personalities, cycloid or psychoneurotic personalities.

Nevertheless, environmental and constitutional factors are frequently inextricably blended, and the prostitute who has been segregated for some weeks (e.g., in prison), deprived of alcohol and physical and moral de-

their fantasy life longer than youths and more inflexibly spiritualize their sexual instinct. Rehabilitation is therefore more difficult if these qualities are wilfully cast aside.

The male prostitute may be an active and masculine person, or passive and effeminate. It is fairly certain that some attractive and good-looking youths are thereby predisposed to prostitution as they attract and are then seduced by homosexual men. The homosexual client usually has as his sexual object a man or boy who conforms to a particular type. The client, however, is not always a homosexual individual, if the term is used to indicate a sexual activity in which complete satisfaction is sought for and obtained without the necessity for heterosexual intercourse. Occasionally the client is afraid of becoming infected by venereal disease from intercourse with women, and does not realize that he may be infected by a male prostitute. A libertine sometimes turns to homosexual intercourse when satiated with the pleasures derived from women. There appears to be no reason to think that there is any considerable number of men in this country who hire themselves to women for sexual purposes.

The treatment of male prostitution is closely related to that of homosexuality and the public attitude towards it. At the present time there are two schools of thought. One favours no alteration in the existing law; the other believes that the homosexual should not be penalized unless he debauches a young person, or exploits a person dependent upon him, or offends against public decency, or habitually carries out his activities for financial gain. To these may be added, being in any public place for the purpose of prostitution or soliciting to the annoyance of passengers. It has been suggested that such an alteration in the law would facilitate the prosecution of the male prostitute and his colleagues in blackmail. But the effect upon the incidence of male prostitution seems doubtful.

MEDICAL ASPECTS

Apart from the treatment of venereal disease among prostitutes and their clients, and the prevention of its communication to others, medical men may be concerned with the effects of prostitution in different medico-legal situations. For example, suicide, murder and divorce. And here note the fact that a large number, some observers say the largest number, of a prostitute's clients are married men who turn to her because of the indifference or aversion of their wives to the intimate relations of marriage, or for other reasons.

A medical assessment of the individual prostitute may be necessary in order to determine to what extent, if any, her mode of life is a regressive manifestation indicating a retarded state of sexual development. It may be necessary also to decide whether mental defectiveness, psychopathic state, psychoneurotic or psychotic disorder has contributed to the result.

Much has been written about the sexuality of the prostitute. But perhaps this is less significant than it appeared to be when the sexuality of woman was little understood. The literature affords examples of hypersexuality, hyposexuality and homosexuality among prostitutes as well as among non-promiscuous women.

There is a close association between crime and prostitution. That is to say many prostitutes commit minor offences, such as thefts, and some become involved in major crimes, for example, blackmail and murder. The majority who came under my observation some years ago were frequently convicted of drunkenness. On the other hand, the relation between prostitution and drug addiction is insignificant in England, probably because drug addiction itself is infrequent. American observers have been impressed by the association in the United States. Wolff (1943) refers to the relation between drug addiction, disorderly conduct, vagrancy and prostitution. Lindesmith (1941) contends that the proportion of addicts who are vicious criminals is relatively small, but on the average the addict is a petty thief, a prostitute, or a drug pedlar. At least this may be accepted: the prostitute, the petty thief, the alcoholic and the drug addict show a marked tendency to combine in themselves various forms of antisocial behaviour and to repeat their activities.

Preventative measures.—It is sometimes forgotten that prostitution may affect the lives of other women. Katherine B. Davis (1929) found that of 1,006 unmarried women only 2.9 per cent. considered that it was a necessary evil; the majority were opposed to it. Whatever the relation between the prostitute and other women few will doubt that the former should be reclaimed if possible. The segregation of mentally deficient women and girls in appropriate institutions, the early treatment of those suffering from other predisposing mental states, religious teaching, education in citizenship, and efforts combating the associated environmental factors have preventive effects, and supplement the rescue work undertaken by official, religious and social organizations. Further results may be obtained if a Pharisaical attitude towards the problem is discarded, and the fact accepted that the prostitute often has more excuse for her occupation than her client has for his libertinism.

MALE PROSTITUTION.—The number of male prostitutes must be almost entirely a matter of conjecture and is related to the problem of homosexuality. There is no doubt that a proportion of male prostitutes are not themselves homosexuals but accept this occupation as an easy means of earning a living in an atmosphere of gaiety and excitement. Experience among adolescents who have been convicted of various offences suggests that many adolescent male prostitutes discontinue their occupation more easily than is the case with adolescent girls: not because they are more repentant, but because the girls often believe that they cannot regain their lost honour. Note also the fact that during adolescence girls usually retain

SEXUAL PERVERSIONS AND THEIR TREATMENT

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THERE is no sharp dividing line between sexual perversions and normal manifestations of sex. Thus, for example, homosexuality should be regarded as a normal phase of development; similarly, sadism and masochism are normal components of the sexual impulse; and the same principle holds true for sexual fetichisms. There is, in fact, in the sexual as in other spheres, a very wide range of normal human variation.

In practice the essential issue is not the apparent abnormality or "perversity" of the sexual manifestation that may be encountered, but its dominance. The sexual pervert may therefore be defined roughly as an individual who shows an undue persistence or dominance of a normal sexual component, using "normal" in the sense of something that may frequently be observed.

The origin of sexual abnormality or perversion must be sought (a) in our biological constitution, and (b) in special experiences that may have tended to reinforce innate tendencies of constitutional origin. Thus, taking the association of love and pain as an example, Havelock Ellis has pointed out that "the intimate and inevitable association in the animal world of the fighting and hunting impulses with the process of courtship alone suffices to bring love into close contact with pain", so that from one aspect "courtship may be looked upon as a refined and delicate form of combat".

The origin of the association between love and pain is, according to this view, traceable to the phenomena of animal courtship; and whether this is true or not, it is at all events widely held that the association, when it occurs, of the sexual impulse with the desire to draw blood (by biting or stabbing), to beat or to be beaten, or to watch or to participate in spectacles of pain and struggle, and so on, has a deeply seated biological origin.

Tendencies in these and other "perverse" directions are certainly frequent; and in the study of patients with abnormal sexual impulses it is often possible to obtain a history of how these presumably innate tendencies (doubtless varying in strength in each individual) have been reinforced by chance in the form of special experiences. Thus, many sufferers from sexual abnormalities are able to recall quite clearly the association, in their childhood or youth, of an early sexual arousal with an episode or experience that provided, to the best of their recollection, the first example of that unusual sexual linkage that later came unduly to dominate and perhaps to blight their lives.

A grave situation arises when a man seeks medical advice because he believes that his sexual urge is so dominating that his health will be adversely affected if he remains chaste. One school of thought censures masturbation but is inclined to tolerate prostitution. Another proclaims the physical and moral dangers of prostitution and clarifies the position as regards the alleged harmfulness of occasional masturbation. A third believes that patients may gain most help if they are reminded that eminent medical men and others have no doubt that continence is consistent with full health and efficiency. McDougall (1928) wrote: "A strong man can live, and live well, without love and without indulgence of the sex tendency. The latter may cause him some inconvenience at times, but not to a serious degree unless he becomes afraid of it".

In every case it seems desirable to put the medical, social and moral issues before the patient. The doctor can advise; the patient must decide. And in doing so he may profitably bear in mind the fact that the chief cause of the prostitution of women is the demand made and maintained by men.

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A good example of this was afforded by a High Anglican padre, a man of high standards and morale, who was consciously a homosexual but a well-sublimated one. He developed, however, a typical anxiety exhaustion syndrome as a result of prolonged and severe stress in the war and, in this condition, indulged on one occasion in active homosexual practices which subsequently became a source of severe self-reproach and shame: so that when this man was seen at a later date he was suffering from a fairly severe self-reproachful depression (melancholia).

Possibilities of this kind are always worth bearing in mind. A number of patients, when in a state of depression, become self-reproachful over unusual sexual components in their make-up. In some cases, as in that quoted, worry over a sexual lapse has considerable etiological importance in precipitating the depression, but in the majority of depressions the topic of self-reproach is not so much the cause of the depression as the consequence.

There remain, however, a large number of cases in which the difficulties should neither be regarded as due to over-emphasis upon something that, with education, can essentially be neglected, nor as symptomatic of some other psychiatric syndrome.

THE PROBLEMS OF TREATMENT

One of the main difficulties in attempting to treat those cases in which some sexually abnormal impulse does in fact unduly dominate the sexual life, is the very comprehensible difficulty in cooperation shown by the patients who seek or are sent for treatment.

The point was put very clearly by a man whom I was recently asked to see for a sexual offence, who said: "Since I was up before the Beak a fortnight ago," (the case had been remanded for two months) "I have been thinking over my problems a great deal. It seems to me mine differs from other medical conditions—if it is a medical condition—because it did give me pleasure".

Important issues are therefore to try to determine to what extent the patient genuinely desires to change and to what extent he is capable of changing. At this point it may be said that the chance of a real and genuine change, in the sense of a complete cessation or alteration in the abnormal sexual impulse, diminishes rapidly after youth and is usually small in patients who have passed the age of twenty-five. All that can usually be done in these more established cases is to try to get the patient to bring his difficulties into better perspective, to face them more openly, and hence to be in a better position to cope with them; and it may be added that a lot can often be done in these ways.

Starting first with the younger age-groups and taking homosexuality as an example, it must, as stated previously, be recognized that homosexuality is an extremely frequent phase in development and is often reinforced or maintained by special circumstances, as at school. It is therefore unwise to make a diagnosis of a constitutional homosexual before the age of twenty-five. In the younger age-groups, a frank discussion of the whole position should obviously be the first step. The majority of those with sexual

THE ASSESSMENT OF THE SIGNIFICANCE OF SEXUAL ABNORMALITY

The recognition of the point that an essential practical issue is not so much the apparent abnormality or perversity of the sexual manifestation, as its dominance, has important therapeutic implications. For example, at one end of the scale there are many patients who are extremely troubled by what they regard as the abnormality of their sexual life, when inquiry reveals that they were but worrying unduly about an unusual component that is by no means a dominant one. An example may make this point clear.

A young man of twenty-five was referred for a psychiatric opinion because of various anxiety symptoms. It soon transpired that he had fallen deeply in love, but had developed a severe conflict as to whether he should propose or marry because he regarded himself as a sexual pervert. His reasons were that periodically, and in fact infrequently, his sexual fantasies were of flagellation. He was a conscientious individual, with high ethical standards, who was ashamed of and horrified by what he regarded as his guilty secret, which he had not previously mentioned to anyone. He had an excellent school and work record and seemed to be the possessor of a thoroughly sound constitution and personality. His difficulties seemed clearly to result from a mixture of ignorance and conscientiousness.

Cases of this type, and they are not uncommon, usually do not need more than explanation and reassurance, with special emphasis on the frequency, and hence normality, of what seem odd sex linkages.

As might be expected, an unusual component or tendency in the sexual life that did not intrude, or could be dealt with satisfactorily, when the subject was in a good state of health, may become unmanageable, or the source of grave concern, when the state of health suffers from whatever cause. A number of abnormal sexual manifestations should therefore be regarded as symptomatic or "release" phenomena.

Organic "release" cases.—Obvious examples are provided by the homosexual advances, or exhibitionism before young girls, that are apt to be shown by early cases of arteriosclerotic dementia or senility. The onset of abnormal sexual impulses or practices occurring for the first time in the later decades of life should always suggest such an origin. (And in connexion with these cases it may be observed that further evidence in favour of the ubiquity of abnormal sexual tendencies is furnished by the fact that the most careful study of many of these cases fails to disclose evidence of obviously abnormal tendencies in their past history.) The same effect can of course result from organic cerebral disease when occurring at an earlier age. For example, one of the most distressing symptoms in the case of a relatively mild post-concussional syndrome was the unbridled display of sadistic behaviour which, prior to the concussion, had been kept under reasonable control.

CASES ASSOCIATED WITH OTHER PSYCHIATRIC SYNDROMES

Similarly, the power of inhibition or self-control may be reduced as a result of functional nervous disorder.

readily grasped the point that the desire to relieve boredom played a large part in producing his difficulties.

In this case the most reasonable form of treatment would seem to be (1) sensible discussions so that he might face his difficulties more openly; (2) that he should, so far as possible, avoid exposing himself to temptations, for as in all sexual matters the sexual appetite grows with stimulation; and (3) that he should lead a more mentally hygienic life and be more fully occupied. This particular patient had an off licence, so that he was in effect unemployed in the afternoon, which for him was the dangerous time; (4) he was told that should he experience the feelings come over him again he might be considerably helped by bromides or other sedatives.

This particular case also raised the question as regards the possibility of a relapse. It is impossible to state that such a case would not relapse, but it did seem reasonable to suppose that the risk of this would be materially reduced as the result of what had occurred. Psychotherapeutic attempts were, however, probably less important in reducing the risk of a relapse than the fact that his conviction had forced him to face the serious consequences that would ensue should his offence be repeated.

Many perverts, however, are unnecessarily worried as to whether they may not indulge in their perverted impulses. For example, like many other psychiatrists I saw a number of patients after the Heath trial who had throughout their lives been troubled by sadistic impulses and who feared that they might behave like that well-known sadistic murderer. It is quite legitimate to reassure such patients that there would be no risk of succumbing to any such temptation, for Heath was an example of an unusual combination, since he was a grossly psychopathic individual who in addition happened to be sadistic. He indulged in his sadistic enterprises with as little shame or compunction as he had previously indulged in false pretences or in passing dud cheques. Fortunately, however, there is no necessary connexion between perverted sexual impulses and unrestrained psychopathic behaviour that is manifest in sexual or other ways, and many sufferers from abnormal sexual impulses are otherwise perfectly normal individuals with a high sense of duty and a strict code of behaviour.

SUMMARY

To recapitulate it may be said:—

(1) The first issue is to determine how dominant the particular sexual perversion may be, and in particular whether it should be regarded as a passing phase of development or not. The next issue is whether the sexual abnormality should be regarded as "symptomatic".

(2) The ubiquity of abnormal sexual impulses must be recognized.

(3) The fact that indulgence in sexual activities of any kind is associated with pleasure necessarily makes the treatment of sexual abnormalities one of particular difficulty.

difficulties tend to keep these difficulties in a special compartment in their minds and not to face them openly. Discussion of these difficulties with some competent person who is reasonably well informed on sexual matters can therefore be of great value. Not infrequently such simple advice as that a youth should give himself the opportunity of meeting girls will be enough to demonstrate the existence of normal heterosexual impulses.

As regards the confirmed homosexual of constitutional type, an interesting example of the difficulties that may be encountered may be illustrated by the following case:—

A highly intelligent man, aged thirty-nine, came to seek advice as to whether he was curable. He had been a practising homosexual since adolescence without conflict or shame. He had no real desire to change. On the other hand he thought he felt the need of a home life and, above all, realized the legal complications and difficulties that might ensue should he continue with his homosexual activities. He therefore said that he was willing to consider subjecting himself to psychotherapy if there was a reasonable prospect, without too much difficulty, of changing his impulses into a heterosexual direction. The only answer that could be given to such a patient was that the prospect of this would be small, and that whether he indulged in homosexual acts or not was something that he must decide for himself.

Perhaps another case may be quoted to illustrate some of the problems of the exhibitionist and the line of treatment that was recommended.

A man of forty was referred after appearing before a Magistrate for exhibitionistic practices before adolescent girls. His difficulties had started at the age of fifteen but had been strikingly phasic since. Thus, he was quite free from these impulses while serving for seven or eight years in the Merchant Navy, but had a relapse at the age of twenty-eight and again just before the war when he was in the early thirties. This man seemed to have made a good adjustment in life and to have had a good work record before the war. He had also served throughout the war with success, rising to be a Staff Sergeant. Again, during his time in the Army this man was free from his particular temptation. About a year after his demobilization, however, he lapsed once more and had been actively indulging in exhibitionism for some three months before he was caught. He was by profession a licensee but was not an alcoholic and drank very little.

He had had various heterosexual experiences in his life without any abnormal impulses. He explained the fact that he had never married on the grounds that he had an elderly mother with a difficult personality dependent upon him, who in his opinion would be bound to quarrel with any wife, and whom he felt he could not turn out to live by herself as she was a semi-invalid.

As often happens with exhibitionistic cases, a large component in this man's pleasure was the alarm, surprise, or as he preferred to regard it, interest he saw on the faces of the adolescent girls to whom he exhibited his person. He had an erection whilst doing so but this is by no means invariable with exhibitionists.

Now, from the experience of prison psychotherapists, it is known that psychotherapy of an intensive type is of limited value in the treatment of exhibitionism. It would seem that if the shock of a conviction does not make them stop their practices there is a very real risk of a relapse, whatever form of treatment may be given. Hopeful points in this particular case were (1) that he seemed to have a good personality apart from his special trouble; (2) that his desire for exhibitionism came on in phases, with long periods of freedom in between, and (3) that he was an intelligent man who

readily grasped the point that the desire to relieve boredom played a large part in producing his difficulties.

In this case the most reasonable form of treatment would seem to be (1) sensible discussions so that he might face his difficulties more openly; (2) that he should, so far as possible, avoid exposing himself to temptations, for as in all sexual matters the sexual appetite grows with stimulation; and (3) that he should lead a more mentally hygienic life and be more fully occupied. This particular patient had an off licence, so that he was in effect unemployed in the afternoon, which for him was the dangerous time; (4) he was told that should he experience the feelings come over him again he might be considerably helped by bromides or other sedatives.

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(2) The ubiquity of abnormal sexual impulses must be recognized.

(3) The fact that indulgence in sexual activities of any kind is associated with pleasure necessarily makes the treatment of sexual abnormalities one of particular difficulty.

(4) It is very easy for habit formation to occur in the sexual sphere, and the longer these habits persist the more difficult they are to break. Consequently, the younger the patient the better is the prospect of breaking habit formations. Thus it is important to point out to young people with abnormal sexual impulses, or who describe particular sexual fetichisms associated with their masturbatory fantasies, that the more they permit themselves indulgence in these fantasies the more is it likely that these fantasies will grow.

(5) For much the same reason it is important that individuals with sexual abnormalities should avoid exposing themselves to external situations which will tend to stimulate and hence to increase their particular desire.

(6) It is particularly important for individuals with abnormal sexual impulses to lead a life that is mentally hygienic and provides satisfactory opportunities for healthy outlets and activities. There can be no doubt that indulgence in sexual practices is often a relief from boredom—"The Devil finds work for idle hands".

(7) It is often helpful for patients with sexual abnormalities to discuss their problems with some outside person, such as their medical attendant, for there is a strong tendency to lock them away in a special compartment in their mind, and frank discussion permits them to see their problems more clearly, and hence to be in a better position to cope with them.

(8) There is a definite place for sedation in the treatment of sexual difficulties. For example, a number of individuals are troubled by a periodic uprising of sexual impulses before they go to sleep. For such cases a rapidly acting drug, such as nembutal, may be a great consolation and help.

(9) The desire and capacity of the patient to cooperate is of primary importance as regards possibilities of treatment and also as regards the prognosis. The better the personality the better are the chances for self-control as regards manifest performances. It is possible that a certain amount of harm has been done by regarding all sexual perverts as sick people, because of the frequent association in the public mind between illness and irresponsibility. Sexual abnormalities are certainly handicaps but they should not be regarded as insuperable handicaps. In brief, there is a real place for self-control and self-restraint.

(10) What finally can be said as regards the value of intensive psychotherapy? It would seem unlikely that if, in fact, successes had frequently been achieved by this method they would have gone unrecorded to such a striking extent, and little evidence has been put forward that intensive psychotherapy is of special value in the treatment and cure of sexual disabilities in themselves. It is dubious whether it is likely to be of more benefit than less expensive and laborious methods in any individual who comes complaining of some sexual abnormality and in effect of nothing else. This is not in any way to doubt the value of intensive psychotherapy for those who show a more general maladjustment in their lives in which their sexual problems may play an important part.

LEGAL ASPECTS OF ARTIFICIAL INSEMINATION

BY THE RIGHT HON. HENRY WILLINK, M.C., K.C., M.P.

OUR Courts of Law have not as yet been faced with the problems suggested by the development of artificial insemination of women, and it is not possible to do more than give expression to such opinions as one has been able to form. None the less it seems desirable, if not necessary, that medical practitioners in particular should have such guidance as can be given by a statement of certain general principles and by such indications as can be given of a number of legal complications which seem to be involved.

I myself would not even claim to be expert in the relevant legal field, far less to have either the personal knowledge of the hard cases or the personal experience of the scientific urge which has led to these experiments. But my attention was directed to the subject by a Parliamentary question addressed to myself as Minister of Health on April 19, 1945,* and since my return to professional life I have given considerable thought to its legal aspects.

On the occasion to which I refer I formed the view that the subject was far from being of merely departmental concern; although, maybe, practised on a small scale, it seemed to me to be of deep social importance. So now I feel that to write on legal aspects alone is to neglect equally weighty considerations—genetic, sociological and moral. It will not, I hope, be assumed from any apparent narrowness of approach that I am insensitive either to the tragedies that arise from sterility or to the wider issues which impress many who have given thought to the subject as more serious than the purely legal.

Assuming that what is under consideration is the impregnation of women by means other than normal intercourse, it is convenient to consider the question under three categories:—(a) impregnation of a wife with the semen of her husband; (b) impregnation of unmarried women who desire to conceive; and (c) impregnation of a wife by the semen of a “donor”.

THE PROBLEM OF NULLITY

As to the first of these categories, with one exception, no legal problem need arise. There may, if the methods are experimental, be technical difficulties: the doctor will have his normal duty to exercise the professional skill and care which the situation demands. But the question whether or not the technique should be employed will not be embarrassed by any inherent legal complication. I reserve only what seems to be a question which might

**Hansard*, Vol. 410, column 379.

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never arise but is of some difficulty. It is settled law that a decree of nullity—on the ground of wilful refusal to consummate the marriage—may be made, although, as a result of pre-marital intercourse, there is a child. It seems not impossible that a husband or wife might obtain a decree of nullity in the event of refusal, on the part of the other spouse, of normal intercourse and insistence on artificial insemination, even after a child or children had been born.

THE UNMARRIED WOMAN

The second category is, of course, at the opposite pole from the first, and I have some doubt if, even in an age of shifting principle so far as marriage is concerned, the dangers need be indicated. There are, no doubt, women to whom marriage is repugnant or unavailable but who ardently desire to be mothers; to some of these, insemination by artificial means might appear a not impossible way of achieving their ambition. It is obvious, however, that a doctor who acceded to such a request by an unmarried patient might find that he had given an opportunity for fraud or blackmail. The request might in reality be due to a wish to force marriage on a man with whom the woman had had intercourse. If successful, the technique might induce an unwilling and unsatisfactory marriage, and a child ostensibly legitimate but in fact bastard. Alternatively, should the woman remain single and if by some mischance the identity of the donor ever became known, he could be made liable to maintain the offspring.

DOES ARTIFICIAL INSEMINATION CONSTITUTE ADULTERY?

I pass therefore to the third category and the consideration of some legal aspects of the proposition that in the case of proved marital impotency or sterility it may be desirable to induce ostensible offspring to a marriage by the use of the semen of a donor. I assume throughout (a) that the technique is only employed at the joint request of both husband and wife; (b) that the identity of the donor is not disclosed to either, and (c) that the donor is selected by the doctor with all possible skill and care.

The first question that arises is does the acceptance of such treatment by a married woman constitute adultery? As to this, although there is no binding decision of which I am aware, there can, in my opinion, be no doubt that the answer is in the affirmative. I know of no attempt to give an exhaustive definition of adultery, but on the particular question under consideration I feel confident that an English court would follow what was said by Lord Dunedin in a very well-known case*:

"The appellant conceived and had a child without penetration having ever been effected by any man; she was fecundated *ab extra* . . . The jury came to the conclusion that she had been fecundated *ab extra* by another man, unknown, and fecundation *ab extra* is, I doubt not, adultery."

**Russell v. Russell*, 1924, A.C., p. 687, at p. 721.

In a Canadian case* the Court expressed its view clearly, although not, in view of the facts of the case, in circumstances that make the decision binding in any other Court:—

"The essence of the offence of adultery consists, not in the moral turpitude of the act of sexual intercourse, but in the voluntary surrender to another person of the reproductive powers or faculties of the guilty person, and any submission of those powers to the service or enjoyment of any person other than the husband of the wife comes within the definition of adultery . . . it is not the moral turpitude that is involved, but the invasion of the reproductive faculty . . . Assuming the plaintiff's story to be true, what took place was the introduction into her body by unusual means of the seed of a man other than her husband. If it were necessary to do so, I would hold that that in itself was sexual intercourse."

On these quotations I would add two comments.

First, it was, I think, *per incuriam* that the Canadian court† appeared to limit adultery to cases in which there was a "reproductive faculty". It is in my view clear that adultery occurs when a woman's organs of generation are surrendered to a man other than her husband, known or unknown, whether or not she is capable of conception or generation. In the second place I would stress that the adulterous character of an act cannot be removed by the consent of the other spouse. Its consequences may be affected by connivance or condonation, but it remains an act of adultery.

What, in the next place, of the donor? I have seen it suggested that no donor should be employed who had not given proof of his procreative powers by being already the father of two healthy children. There can be no doubt that the action contemplated would constitute adultery on the part of any married donor.

THE PROBLEM OF LEGITIMACY

If these views as to the adulterous character of what is commonly known as A.I.D. (Artificial Insemination by Donor) are correct, it is not difficult to deal with the question of legitimacy. I am glad, however, to cite, in support of my own view, that children conceived by this technique are clearly illegitimate, an article by Mr. Sidney B. Schatkin, Assistant Corporation Counsel of the City of New York (1945):—

"The question of the legitimacy of a child born under such circumstances‡ has never been judicially considered, but was the subject of an editorial in the *Journal of the American Medical Association* (May 6, 1939), which took the view that the child is illegitimate. No matter how much one may be inclined to confer legitimacy on such a child, the force of the following observation contained in the editorial cannot be disputed: 'The fact that conception is effected not by adultery or fornication, but by a method not involving sexual intercourse, does not in principle seem to alter the concept of legitimacy. This concept seems to demand that the child be the actual offspring of the husband of the mother of the child . . . If the semen of some other male is utilized, the resulting child would seem to

**Orford v. Orford*, 58 D.L.R. 251.

†As also Mr. Schatkin in the passage next quoted.

‡viz., A.I.D. with the husband's consent.

be illegitimate. The fact that the husband has freely consented to the artificial insemination does not have a bearing on the question of the child's legitimacy. If it did, by similar reasoning it might be urged that the fact that a husband had consented to the commission of adultery by his wife would legitimize the issue resulting from the adulterous connexion.'

"If we are to regard adultery in its essence as the surrender of the wife's reproductive powers to another man, then we may conclude that the husband has no greater moral right to consent to artificial insemination than to the commission of adultery by his wife. As pointed out in the above editorial, the husband's consent does not alter the fundamental conception of legitimacy, which requires that the child be the actual offspring of husband and wife. If that concept be violated, even with the best intentions, the resulting offspring is illegitimate."

THE ONUS OF SECRECY

It is in the light of these conclusions that, as I understand the proposed technique or practice of A.I.D., the most serious legal considerations arise. Secrecy is of its essence. The anonymity of donors is to be strictly preserved, as is, indeed, most necessary for their protection: should their identity be discovered, they would be liable to maintain their offspring however numerous—and they might be very numerous indeed—if the mothers were unmarried or married women living apart from their husbands.

But the secrecy is not primarily for the protection of donors: its main purpose is to introduce into the family and into the community a child which shall be believed to be the offspring of the marriage, which it is not. To this end "the couple are informed that the child will be legitimate if the husband is registered as the father: such registration is demanded although it constitutes an offence" (Barton, Walker, and Wiesner, 1945). Apart altogether from the very weighty arguments in favour of children being in a position to know their parentage, I would have expected a less cavalier attitude to the Perjury Act of 1911, under which a sentence of seven years penal servitude may be given for the offence in question. Medical practitioners, who in the practice of A.I.D. would not, *ipso facto*, be any more than accomplices in adultery, might well hesitate before "demanding" the commission of such an offence, an act which would of course involve themselves in grave criminal liability.

But the secrecy proposed has more remote consequences against which the safeguards at present suggested are quite futile. It has been recommended that the practitioner should obtain an assurance "that the birth of a child will not defeat the claims of any person to any titles, estates, interests or funds". A moment's reflection makes it clear that no married couple can conscientiously give such an assurance as to the future. Nor is it merely that unanticipated deaths or a change of intention may alter rights to succession; it has been forgotten that concealment of illegitimacy operates as a fraud on the revenue, to which a higher duty is payable on the succession of an illegitimate child than on the succession of legitimate issue. Moreover, it is clear that, even when the intention of the spouses at the time is wholly

free from fraud, the assumed necessity of concealing the truth from the child may make fraud as against other persons almost inevitable at some future date. This will not only be the case when substantial proprietary interests or funds are concerned; it will arise whenever gifts or services are offered, e.g., by the husband's parents, on the implicit basis that the child is their son's.

THE PROBLEMS OF THE OFFSPRING

It is not within the province of this article to assess the supposed benefits to the spouses and to their ostensible child, nor to consider when, if at all, the child should be told the circumstances of his conception. It is right, however, to point out that so long as the family remains a basic element in human society a child so begotten will be obliged, if he is kept in ignorance, to deceive very many with whom he comes in contact throughout his life.

There is a further complication to which unascertainable parentage gives rise and to which I should refer. The authors of the article in the *British Medical Journal*, which I have quoted, have satisfied themselves that "a fecund donor, submitting two specimens weekly could, with ideal conditions, produce 400 children weekly (that is, about 20,000 annually)". They themselves "have set an arbitrary limit of 100 children for each donor—not yet attained by any one donor". I apprehend that the law with regard to incest is not unsupported by scientific considerations; but A.I.D. would seem to open a very wide door to the mating of the children of one father.

CONCLUSION

It is often the function of a lawyer to anticipate and formulate the difficulties that may follow upon a suggested course of action. That has been the purpose of this article. But can they be avoided? Can any scheme which would preclude confusion and fraud be devised? I cannot think that anything on the lines of a register, as for adoption, could meet the case. I cannot think that it would be honestly used. The fact is that the practice treats the wishes of the spouses as being of exclusive relevance. The law is bound to take a wider view and to consider the welfare of the community as a whole.

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PAIN AND ITS PROBLEMS

IV.—PAIN IN DISEASE OF THE NERVOUS SYSTEM

By SIR CHARLES SYMONDS, K.B.E., C.B., D.M., F.R.C.P.

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PAIN may be a symptom of disease in any part of the sensory nervous system, from peripheral nerve to cortex, being presumably due to abnormal activity in nerve endings or fibres, which, although they are damaged, can still be stimulated and conduct the nervous impulse.

TYPES OF PAIN AND THEIR ORIGIN

In *peripheral nerve lesions* due to injury, inflammation or pressure pain may be a striking symptom, though not uncommonly absent. The outstanding example is *causalgia*, described in this series by Gordon Holmes (*The Practitioner*, February 1947, p. 165). In nerve lesions it is the rule for the pain to be associated with *paræsthesiæ* of appropriate distribution, which, together with sensory impairment and muscular weakness, indicate the anatomical site of the lesion. When more than one nerve is involved, as in *polyneuritis*, pain is uncommon, the complaint being generally of tingling and numbness in the extremities, but muscular cramps are sometimes prominent, and in some cases of alcoholic and diabetic *polyneuritis* stabbing pains in the course and distribution of the peripheral nerves may be a troublesome symptom.

Root pain due to disease or injury of the posterior nerve roots is more important because so much more common. Its quality and distribution are usually characteristic and distinctive. In the early stages it is periodic; later continuous but subject to exacerbations. It is described as aching, boring, and sometimes stabbing, and is usually referred deeply, although often associated with superficial burning and tingling. It is frequently provoked or aggravated by certain postures and movements, by jarring or jolting, and by coughing, sneezing or straining at stool. Its distribution follows that of the root affected. Thus involvement of the second cervical root causes pain radiating from the neck up the back of the head; of the seventh cervical, pain along the back of the arm and extensor aspect of the forearm; of a thoracic root, pain around the chest and abdomen; of the second or third lumbar roots, pain from the upper gluteal region spreading round to and down the front of the thigh, and of the fifth lumbar and first sacral roots down the lateral or posterior aspects of thigh, leg and calf into the lateral aspect of the foot and the heel. Root pain radiating round the abdomen from a thoracic lesion may be mistaken for visceral disease, but its quality and zonal distribution are usually distinctive. Pain radiating down the length of a limb always raises the suspicion of a radicular origin and demands a careful search for other evidence of root involvement—motor, reflex or sensory—and clinical and radiological examination of the spine.

The causes of root pain are numerous. One of the most frequent is a prolapsed intervertebral disc, now recognized as the common cause of sciatica and certain cases of what has in the past been called brachial neuritis. Malignant growth of the spine or the extradural or paravertebral tissues is another common cause: when root pains develop in a patient known to have had malignant disease it is pretty safe to assume this origin even though X-rays of the vertebræ are normal. Spinal osteoarthritis or tuberculosis, syphilitic meningitis, and tumours of the spinal cord, extra- or intra-medullary, are other causes which must be borne in mind.

Central pain is a term used for pain due to lesions in the central nervous system. Disease of the spinal cord rarely causes pain as a leading symptom, although with partial lesions of the posterior horns or spinothalamic tracts there may be complaint of burning or stabbing pain of appropriate distribution, which may be a prominent symptom in recent injuries of the cord, and in some cases of intramedullary tumour or syringomyelia. It is not, however, until the level of the optic thalamus is reached that pain as a constant and prominent symptom of lesions of the sensory pathway is present.

THE THALAMIC SYNDROME

The thalamic syndrome, so-called, is ordinarily the result of a hæmorrhage or thrombosis. The symptoms in the early stages are those of sensory impairment, often associated with weakness involving the face, trunk and limbs on one side. The defect as a rule involves all forms of sensation, cutaneous and deep. Sometimes from the first, but more often after an interval of some weeks, the patient complains of pain in the affected parts, which may be comprehensive in its distribution but is usually worst in the extremities. The pain is continuous, usually severe, and is described as burning, stabbing, boring or aching. Sometimes there are sensations as of the hand or foot being crushed or twisted. Associated with this there is cutaneous hyperalgesia, so that the sufferer dreads any stimulus which is capable of eliciting sensation. Sensory examination shows that there is impairment of sensibility, the true state of affairs being a raised threshold with over-reaction. The stimulus which excites pain must have a certain mass, which seems to depend upon the number of end-organs excited. Stroking contact is more effective than touch, a scratch more than a prick. Once developed the thalamic syndrome tends to persist. Both pain and hyperalgesia are worse when the patient is short of sleep, fatigued or anxious.

In *treatment* it is necessary to give analgesics and hypnotics in sufficient quantity to ensure good nights. A combination of aspirin, 10 grains (0.6 gm.) codeine, 1 grain (0.06 gm.), and medinal, 5 to 10 grains (0.3 to 0.6 gm.) is often effective. If it is not, a powder containing aspirin, 10 grains (0.6 gm.), and heroin hydrochloride, 1/6 of a grain (0.01 gm.) may be necessary. The aim should be, of course, to give the patient as little as possible, but if he becomes demoralized from lack of sleep the ultimate risk of drug addiction is greater than if adequate doses are given in the early

stages. This implies that the pains of the thalamic syndrome tend to become less with time, which is generally true if the patient can be kept interested and occupied. Massage and electrical stimulation only increase the pain and should therefore be avoided. The under-garments should have some elasticity and fit tightly so that skin friction is minimal, and the patient should be protected from sudden changes of temperature. He should, however, be encouraged to use the limbs as much as he can. Dread of contact may become obsessional and add to the disability.

TABES DORSALIS

In *tabes dorsalis*, pains of a characteristic type are often an early symptom. These are the so-called lightning pains. The patient describes momentary shooting pains, nearly always beginning in the legs and occurring in bouts with considerable intervals of remission. During a bout the stabs may recur in the same spot or flit from place to place. In the earlier attacks they are not always severe, although they are so sudden as to be startling. The patient often dismisses them as rheumatic. As the disease progresses the severity of the pains increases, the bouts are longer and the remissions shorter. Most patients describe a greater liability during cold or damp weather. In the advanced stages of the disease lightning pains may be of excruciating severity.

Treatment.—When the attacks of pain are of moderate degree they may be subdued by aspirin and codeine. A bout of lightning pains may sometimes be aborted if the sufferer takes a bath as hot as he can tolerate and a dose of aspirin at the same time. For very severe attacks nothing but opiates will give relief. The combination of aspirin, 10 grains (0.6 gm.), with heroin hydrochloride, $\frac{1}{6}$ of a grain (0.01 gm.), in a powder four-hourly, should first be tried. If this is not effective, hypodermic injections of morphine must be given. In such cases it may be inhumane to withhold from the patient the means of giving himself relief by injection when he is suddenly overtaken by a severe bout of the pains. As the intervals between such severe attacks usually last two or three weeks and the attack itself for not more than two or three days, the danger of morphine addiction for an intelligent person is not very great. It does, however, exist and the patient must be warned against it. If the *tabes* is treated early the lightning pains sometimes cease, and this can also occur with spontaneous arrest of the disease, but in most cases they continue, even though the blood and spinal fluid become normal and the progress of the disease has ceased. Thus the persistence of lightning pains in *tabes* is not in itself an indication of activity of the disease or of need for further anti-syphilitic treatment.

TRIGEMINAL NEURALGIA

Neuralgia, meaning pain of nervous origin but of unknown cause, is still a convenient designation. The best known example is trigeminal neuralgia. This is essentially a malady of late middle life and old age, although it may undoubtedly occur earlier. Its characteristic features may be summarized

as follows:—(1) The pain is paroxysmal in character; (2) it occurs in bouts with intervals of complete freedom; (3) during a bout a paroxysm can be provoked by contact of trigger areas; (4) the pain is limited to the distribution of the trigeminal nerve or its branches; (5) there is no loss of any of the motor, sensory or reflex functions served by the trigeminal nerve.

Trigeminal neuralgia usually begins in a single division, most commonly the second, after this the third, and very rarely the first. To begin with it is restricted to a small area but tends to spread in successive bouts and eventually extends to all three divisions. The pain is shooting or stabbing, the duration of a single paroxysm varying from a few seconds to as many minutes. Paroxysm may follow paroxysm so quickly that the patient may describe the pain as continuous, but it is always, strictly speaking, intermittent. After a paroxysm there may be an aftermath of aching, but there is never any complaint of tingling or numbness. Trigger points are usually, but not always, present. They may be situated on the skin or mucous membrane, and the patient learns to dread and avoid contact with the particular spot. This is often described by him as being tender, but in fact the pain resulting from local contact is explosive and often remote. In third division neuralgia, movement of the tongue, lips or jaws may be a provoking cause, so that the sufferer is afraid to eat or speak. The picture of mute emaciation and terror in a severe case is unforgettable. The duration of the first attack is often not more than two or three weeks, with subsequent freedom for many months, sometimes a year or two, but with the progress of time bouts become longer and remissions shorter, whilst the distribution of the pain tends to spread. A curious fact of trigeminal neuralgia is that it seldom awakens the patient from sleep.

The *diagnosis* of trigeminal neuralgia is usually made without difficulty by means of the clinical features which have been described. Paroxysmal pain arising from dental caries may be distinguished by the observation that the pain in such a case can be reproduced by appropriate stimulation of the affected tooth. The teeth should always be examined, but needless extraction is a bad error. Dental surgeons who are not aware of the natural history of the disease are apt to believe that if a bout of neuralgia subsides after extraction, it may be after days or weeks, this is proof of dental cause.

Treatment.—The only effective treatment of trigeminal neuralgia is destruction of the sensory pathways concerned, by alcohol injection or surgical division. The injection of second or third divisions gives relief for a time only, usually for a year. Injection of the Gasserian ganglion or division of the sensory root gives permanent relief.

The choice between injection and operation depends upon many variables which cannot be fully discussed here, but the main arguments will be summarized. Injection of the third division is relatively easy, and a successful injection may give relief for several years. For a neuralgia limited to the third division, injection should therefore be the first step in treatment. For a second division neuralgia the prospects of any long duration of relief are much less; but again injection is usually the best initial step. When pain

has recurred after the injection of second or third division a repetition of the injection is unlikely to give long relief. Therefore in such cases it is necessary to decide whether to repeat the local injection or to aim at giving permanent relief by injection of the ganglion or division of the sensory root. If the patient's age and general health are such that the expectation of life is short, local injection should be repeated, otherwise permanent relief should be attempted. Whenever the area of the ophthalmic division is involved ganglion injection or root section are the only means of giving relief, for it is not possible to inject alcohol into this branch. The choice between ganglion injection or operative section depends first upon the fitness of the patient for operation. Many of these patients are old and frail, but the operation under local anæsthesia in the hands of an experienced surgeon is nowadays not a very severe ordeal. In favour of operation is the certainty of relief and the surgeon's ability to leave intact enough fibres from the ophthalmic division to preserve corneal sensibility and thus avoid the danger of ulceration. Injection of the ganglion in skilled hands is generally successful, but the risk to the eye cannot be avoided, and in some cases anatomical variation makes penetration of the ganglion impossible. Thus, in my opinion, operation is the method of choice, and would be done more often if there were enough surgeons with the requisite training and experience.

As the earlier attacks of trigeminal neuralgia are often brief and may be followed by remission for many months, it is well not to be in a hurry to proceed to injection. The time-honoured remedy for alleviation is the tincture of gelsemium, of which 10 minims (0.6 c.cm.) should be given in half an ounce (14 c.cm.) of chloroform water, thrice daily. This will often tide the patient over the earlier bouts, and after this, injection of second or third divisions may give relief for as long as is necessary. Trigeminal neuralgia being a disease of old age, the expectation of life is usually short. When it begins in a comparatively young person with a normal expectation of many years, operation should not be unduly delayed, as either this or ganglion injection will be necessary sooner or later, and it is better for the patient to have the operation while he is fit to stand it.

GLOSSOPHARYNGEAL NEURALGIA

This malady resembles trigeminal neuralgia in every respect except the distribution of the pain, which is referred to the back of the tongue, the tonsil, deeply behind the jaw, and in the ear. Trigger points may be found in any of these areas, the most common being around the tonsil, and pain is characteristically provoked by swallowing. The only means of giving permanent relief is destruction of the glossopharyngeal nerve, which may be achieved by intracranial section, by avulsion after an approach through the neck, or by a similar procedure from the inside of the mouth after removal of the tonsil. The last method has recently been introduced, and has been successful in a case in which the trigger zone was confined to the tonsil and back of the tongue.

POST-HERPETIC NEURALGIA

As the name implies, post-herpetic neuralgia is a sequel, fortunately a rare one, of herpes zoster. For reasons unknown, age is the other essential factor. Post-herpetic neuralgia is seldom seen in persons under the age of fifty, but is a frequent complication of herpes in the seventies. It may follow herpes of any segmental distribution but is especially associated with involvement of the ophthalmic division of the fifth.

Pain of an aching and shooting character often precedes the appearance of the vesicles in herpes; but this is common at all ages and usually disappears in a few days after the herpes has developed. The pain of post-herpetic neuralgia is always associated with some impairment of cutaneous sensibility in the affected segment and with painful over-reaction to contact from stimulation of this area. The pain varies from severe aching and burning to a sensation of intolerable itching, and is continuous. It usually dates from the onset of the herpes but may not reach its height for two or three weeks, tends to remain constant for months or years and then gradually to subside. It was formerly thought to be due to post-inflammatory scarring in the posterior root ganglia, but recent histological studies have shown that the fibres of the root entry zone in the spinal cord are also involved, which explains the oft-repeated clinical observation of failure to obtain relief of the pain by posterior root section. Neither this nor injection of the Gasserian ganglion for ophthalmic neuralgia is successful, and the only surgical means of relief is section of the spino-thalamic tract in the cord, or the quinto-thalamic tract in the brain stem. These are major operations which should not be undertaken unless all other measures have failed.

Treatment.—As in the case of other pains of central nervous origin, the psychological factor is of great importance in post-herpetic neuralgia. If the patient becomes sleepless, exhausted and demoralized, the pain becomes worse and the prospect of eventual improvement small. Therefore in the early stages when the pain is at its height it must be relieved and sleep obtained, if necessary by opiates. A powder containing aspirin and phenacetin, 5 grains (0.3 gm.) of each, and $\frac{1}{6}$ of a grain (0.01 gm.) of heroin hydrochloride, should be given at bedtime and repeated if necessary in the small hours of the morning. If sleep cannot be obtained by other means during the day, alleviation of pain can be obtained by codeine, 1 grain (0.06 gm.), at four- to six-hourly intervals. The patient should be told that the purpose of this generous allowance of analgesics is to tide him over the worst part of the illness and that the dosage will be gradually reduced as soon as he is able to do with less so that he will not become dependent upon drugs. If the patient can be helped by these means to endure the first two or three months there is usually gradual improvement. Deep X-ray treatment directed to the affected ganglia sometimes appears to be of value.

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has recurred after the injection of second or third division a repetition of the injection is unlikely to give long relief. Therefore in such cases it is necessary to decide whether to repeat the local injection or to aim at giving permanent relief by injection of the ganglion or division of the sensory root. If the patient's age and general health are such that the expectation of life is short, local injection should be repeated, otherwise permanent relief should be attempted. Whenever the area of the ophthalmic division is involved ganglion injection or root section are the only means of giving relief, for it is not possible to inject alcohol into this branch. The choice between ganglion injection or operative section depends first upon the fitness of the patient for operation. Many of these patients are old and frail, but the operation under local anaesthesia in the hands of an experienced surgeon is nowadays not a very severe ordeal. In favour of operation is the certainty of relief and the surgeon's ability to leave intact enough fibres from the ophthalmic division to preserve corneal sensibility and thus avoid the danger of ulceration. Injection of the ganglion in skilled hands is generally successful, but the risk to the eye cannot be avoided, and in some cases anatomical variation makes penetration of the ganglion impossible. Thus, in my opinion, operation is the method of choice, and would be done more often if there were enough surgeons with the requisite training and experience.

As the earlier attacks of trigeminal neuralgia are often brief and may be followed by remission for many months, it is well not to be in a hurry to proceed to injection. The time-honoured remedy for alleviation is the tincture of gelsemium, of which 10 minims (0.6 c.cm.) should be given in half an ounce (14 c.cm.) of chloroform water, thrice daily. This will often tide the patient over the earlier bouts, and after this, injection of second or third divisions may give relief for as long as is necessary. Trigeminal neuralgia being a disease of old age, the expectation of life is usually short. When it begins in a comparatively young person with a normal expectation of many years, operation should not be unduly delayed, as either this or ganglion injection will be necessary sooner or later, and it is better for the patient to have the operation while he is fit to stand it.

GLOSSOPHARYNGEAL NEURALGIA

This malady resembles trigeminal neuralgia in every respect except the distribution of the pain, which is referred to the back of the tongue, the tonsil, deeply behind the jaw, and in the ear. Trigger points may be found in any of these areas, the most common being around the tonsil, and pain is characteristically provoked by swallowing. The only means of giving permanent relief is destruction of the glossopharyngeal nerve, which may be achieved by intracranial section, by avulsion after an approach through the neck, or by a similar procedure from the inside of the mouth after removal of the tonsil. The last method has recently been introduced, and has been successful in a case in which the trigger zone was confined to the tonsil and back of the tongue.

POST-HERPETIC NEURALGIA

As the name implies, post-herpetic neuralgia is a sequel, fortunately a rare one, of herpes zoster. For reasons unknown, age is the other essential factor. Post-herpetic neuralgia is seldom seen in persons under the age of fifty, but is a frequent complication of herpes in the seventies. It may follow herpes of any segmental distribution but is especially associated with involvement of the ophthalmic division of the fifth.

Pain of an aching and shooting character often precedes the appearance of the vesicles in herpes; but this is common at all ages and usually disappears in a few days after the herpes has developed. The pain of post-herpetic neuralgia is always associated with some impairment of cutaneous sensibility in the affected segment and with painful over-reaction to contact from stimulation of this area. The pain varies from severe aching and burning to a sensation of intolerable itching, and is continuous. It usually dates from the onset of the herpes but may not reach its height for two or three weeks, tends to remain constant for months or years and then gradually to subside. It was formerly thought to be due to post-inflammatory scarring in the posterior root ganglia, but recent histological studies have shown that the fibres of the root entry zone in the spinal cord are also involved, which explains the oft-repeated clinical observation of failure to obtain relief of the pain by posterior root section. Neither this nor injection of the Gasserian ganglion for ophthalmic neuralgia is successful, and the only surgical means of relief is section of the spino-thalamic tract in the cord, or the quinto-thalamic tract in the brain stem. These are major operations which should not be undertaken unless all other measures have failed.

Treatment.—As in the case of other pains of central nervous origin, the psychological factor is of great importance in post-herpetic neuralgia. If the patient becomes sleepless, exhausted and demoralized, the pain becomes worse and the prospect of eventual improvement small. Therefore in the early stages when the pain is at its height it must be relieved and sleep obtained, if necessary by opiates. A powder containing aspirin and phenacetin, 5 grains (0.3 gm.) of each, and $\frac{1}{6}$ of a grain (0.01 gm.) of heroin hydrochloride, should be given at bedtime and repeated if necessary in the small hours of the morning. If sleep cannot be obtained by other means during the day, alleviation of pain can be obtained by codeine, 1 grain (0.06 gm.), at four- to six-hourly intervals. The patient should be told that the purpose of this generous allowance of analgesics is to tide him over the worst part of the illness and that the dosage will be gradually reduced as soon as he is able to do with less so that he will not become dependent upon drugs. If the patient can be helped by these means to endure the first two or three months there is usually gradual improvement. Deep X-ray treatment directed to the affected ganglia sometimes appears to be of value.

MIGRAINE

Migraine is generally included among diseases of the nervous system and is possibly due to instability of the vasomotor centres, although the pain is

now proved to be due to excessive stretching of the arterial walls in which muscular tone for the time being is defective.

In 80 per cent. of cases there is a family history of the disease, and the attacks usually begin in childhood or adolescence with a marked tendency to diminish in frequency after middle age. The characteristic visual aura is so well known that it need not be described here. The sensory aura is not so widely recognized—tingling in one or other hand spreading slowly upwards to involve the lips and tongue, these often bilaterally. The sequence of events is fairly constant, the aura, whether visual, sensory or visuo-sensory lasting for fifteen to thirty minutes before the onset of the headache. This is often unilateral at first but with a tendency to spread to the other side: an aching or throbbing pain sometimes radiating into neck or face. The duration of the headache is from a few hours to two or three days and when severe it is accompanied by nausea and vomiting.

Treatment.—Many sufferers from migraine will say that their attacks come without any provoking cause, but there are others in whom psychological factors are evident. These are people who in addition to the migrainous liability have anxious and obsessional tendencies and are tense self-drivers, and their attacks occur either at the height of tension or afterwards when tension is suddenly relaxed. These patients may be helped a great deal by judicious psychotherapy and regular small doses of a sedative, such as phenobarbitone, $\frac{1}{2}$ a grain (0.03 gm.) night and morning. Occasionally a migrainous subject learns from experience that some particular food may precipitate an attack, for example, chocolate or shell-fish, but this is rare. Much more often the sufferer, interpreting nausea as evidence of a gastric cause for the attacks, restricts his diet unnecessarily and harmfully. For the relief of pain in an attack aspirin is the most popular and effective drug, in 10 grain (0.6 gm.) doses, repeated three-hourly. It should be taken powdered in a spoon with water to lessen gastric irritation. Compound codeine tablets (N.W.F.), 2 four-hourly, is an alternative. Ergotamine tartrate is effective, not as an analgesic but for its vasoconstrictor effect; it is not of much use by the mouth, although if there is an aura the attack may sometimes be aborted by the prompt ingestion of two or three tablets, each containing 1 mgm. Given by intramuscular injection in a dose of 0.25 or 0.5 mgm. it cuts short the attack in most patients but may induce vomiting. The patient must rest after the injection, when relief is usually obtained within six hours. If initial relief is followed by return of severe headache the dose may be repeated, but not more than once. Some persons cannot tolerate ergotamine owing to cramps, and it should never be given to patients with coronary disease or symptoms due to narrowing of the peripheral arteries.

Migrainous neuralgia.—It had long been recognized from clinical observation that the pain in migraine was not always limited to the head and that in some attacks, or regularly in some persons, it might be restricted to the face. The demonstration by Wolff and others that the pain arises from stretching of the walls of dilated arteries, and that it is the extracranial

arteries which are the chief source of pain, has provided a simple explanation of these variations; pain in face or neck being presumably due to involvement of the occipital and facial vessels. Migrainous neuralgia is a convenient term to describe recurrent attacks of pain in the face, unaccompanied by any signs of organic disease and having certain somewhat characteristic clinical features. The pain may be centred above or below the eye, and is often referred deeply to the ball of the eye or behind it. It is as a rule one-sided. It is continuous and of an aching or throbbing quality, and may be of great intensity. The conjunctival vessels are often dilated during the attack, with watering of the eye, increased nasal secretion and a sense of stuffiness in the nose, and there may be flushing and slight œdema of the infra-orbital region. During and after an attack there may be tenderness to pressure over the supra-orbital and infra-orbital foramina. The course of the attack resembles that of ordinary migraine but there is no vomiting.

The distinction from trigeminal neuralgia is simple if attention is paid to the character and continuous nature of the pain.

The prognosis and treatment are those of migraine. If the attacks are very severe and always on the same side, injection of the Gasserian ganglion or section of its root may be justifiable. Either of these procedures will give permanent relief.

SUPRA-ORBITAL NEURALGIA

This rare condition deserves mention for it may provide a difficult problem in differential diagnosis. The pain is referred to the brow on one side, spreading into and behind the eye: it is aching and stabbing without remission and continues thus for a period of a few hours. The most curious and striking features of its behaviour are in time. It occurs in bouts at irregular and long intervals, and during the bout recurs daily at about the same time. For example, having been free, maybe for a year, the sufferer is attacked at 11 a.m. one morning by pain which lasts until 3 p.m., and the same sequence is repeated day after day for three weeks. In the next bout the daily time of onset may be different, perhaps 5 a.m., but with similar duration.

Both the site and timing of the pain resemble those of a chronic frontal sinusitis, but in the latter the time of onset is fairly constantly two or three hours after rising in the morning, whilst that of supra-orbital neuralgia is more variable. The patient with supra-orbital neuralgia should always be examined for frontal sinus infection, but in true cases of this obscure malady none is found and the attacks continue to recur over a period of many years. Fortunately the pain is of limited duration and can be alleviated by aspirin or codeine. Alcohol injection of the nerve at the supra-orbital notch offers the possibility of relief if the bout is prolonged, but the effect of such an injection is not long-lasting and will probably have worn off by the time the next bout occurs. From migrainous neuralgia this condition is distinguished by its daily recurrence, and from trigeminal neuralgia of the first division by the continuous nature of the pain.

REVISION CORNER

This section is devoted to short articles in which experts summarize modern treatment and clinical procedures, particularly for the benefit of general practitioners who have returned from the Forces.

ANTICOAGULANTS

WHATEVER differences of opinion may exist as to the accuracy of some of the details, general acceptance is given to the main ideas on coagulation of the blood put forward by Morawitz, in 1904. This theory requires the presence in the blood of three substances, fibrinogen, prothrombin, and ionized calcium salts, with the release, when blood is shed, of a fourth, thrombokinase (thromboplastin). This last is formed whenever the tissues, and more especially the blood platelets, are injured. The process of clotting is envisaged as taking place in two stages, in the first of which the inactive prothrombin, in the presence of calcium ions, is converted by thrombokinase into thrombin. In the second stage, thrombin converts fibrinogen into fibrin. In these two processes, both thrombokinase and thrombin act in a manner similar to, but not definitely identical with, that of an enzyme.

From this brief account, it is evident that the whole process could be altered by an anticoagulant substance affecting any one or more of the components involved in either stage. In addition, the enzyme-like action of thrombokinase or of thrombin would be slowed down, *in vitro* at least, by lowering the temperature at which the reaction is proceeding. *In vivo*, although it is true that hæmostasis may be accelerated by the application of cold to the surface of the body, this is due to the vasoconstriction so caused, whilst the coagulation time is not affected.

Fibrinogen is a protein formed in the liver and, naturally, a reduction in its amount in, or its total absence from, the blood would lead to a delay in, or abolition of, clotting. Such a condition has been described but is fortunately rare. Perhaps any really serious damage to the liver might cause such an effect but no drug is known which, in non-toxic doses, can cause a reduction in the fibrinogen content of the blood.

Antithrombins.—It is generally agreed that normal blood contains a small amount of a substance which inhibits the action of thrombin, an antithrombin, and this explains why intravascular clotting does not follow the constantly occurring slight injuries to the tissues with the consequent release of thrombokinase. Substances are known, however, which possess this antithrombin action and which have been used in the laboratory and in clinical practice to delay or prevent clotting. Experimentally, hirudin, secreted by the buccal glands of the leech and extracted commercially from them, is a very powerful anticoagulant, but although it has been much used in laboratory work it does not appear to have been employed in therapeutics. Similarly, certain azo-dyes, e.g. Chlorazol Fast Pink and Chicago Blue, are used in the laboratory but not therapeutically, as being relatively non-toxic and having a strong anticoagulant action, probably acting as antagonists to thrombin. The most potent substance used as an antithrombin in clinical work is heparin, obtained from the liver, and probably arising in the tissue mast-cells. Like some other anticoagulants, it contains several sulphuric acid groups which give it an acid reaction.

Heparin has been obtained in the crystalline form but for clinical purposes a somewhat less pure sample will serve. It is best given intravenously, and, with a sufficiently good preparation, a dose of 10 mgm./kgm. may be given, with no ill-effects but with a considerable increase in the coagulation time. In addition, it prevents the agglutination of the platelets and so limits thrombus formation. Good results have followed its use in blood transfusion, in operations on the blood vessels, and to check extensions of thrombotic changes. It has also been employed as a preventative of post-operative pulmonary embolism, and to prevent fibrinous adhesions in the pleural cavity. At one time, especially in America, subacute

bacterial endocarditis was treated with heparin in conjunction with sulphonamides, with the expectation that the former would prevent further fibrin deposition on the injured valve surfaces. Although many claims of success for this treatment were made, its real value appears doubtful, and it would now seem that in most cases penicillin will give better results.

It has been known for a long time that the intravenous injection of peptone, or the production of anaphylactic shock, is accompanied by a great reduction in the coagulability of the blood. It has recently been shown that this is due to the release of heparin in large amounts, chiefly from the liver.

Another action of heparin is to antagonize thrombokinase, and thus it has a double action as an anticoagulant. A similar action is possessed by certain snake venoms, notably that of the cobra. It is stated that as little as 0.01 mgm./kgm. of this venom will render the blood entirely incoagulable. On the other hand, other venoms, e.g. that of Russell's viper, possess the opposite action, causing intravascular clotting.

A deficiency in the number of platelets, and so of thrombokinase, together with a defect in the capillary wall, may lead to the appearance of purpura, as occurs sometimes after the administration of certain drugs, e.g. sedormid. It is not impossible that the capillary defect may be due, at least in part, to the deficiency of the platelets. Overstability of the platelets, resulting in a lessened release of thrombokinase, is now regarded as the probable cause of the continued bleeding in hæmophilia, in which condition the local use of the venom of Russell's viper has proved effective.

Decalcification of the blood results in the prevention of clotting, and the laboratory use of oxalates, fluorides and citrates is based on this fact. Of these, the first precipitates calcium in an insoluble form, whilst the others form double salts in which the calcium is changed from the ionized to the non-ionized form. Owing to their toxicity, neither oxalates nor fluorides can be used clinically, but sodium citrate has been employed in blood transfusion, the donor's blood being received directly into an isotonic solution of the salt.

Prothrombin is a protein originating in the liver and in the bone marrow, and its production is regulated by vitamin K. In the absence of, or the failure to absorb, the latter, hæmorrhagic conditions are liable to occur, as in severe liver damage, in certain intestinal diseases, as sprue and ulcerative colitis, and in hæmorrhagic disease of the newborn. In the absence of bile salts from the intestine, vitamin K is not absorbed and hypoprothrombinæmia may result, so accounting for the bleeding tendency in obstructive jaundice, and in biliary fistula.

Dicoumarin.—A hæmorrhagic disease in livestock, following feeding on spoiled sweet clover, has been the subject of research since 1940. This has resulted in the discovery of a coumarin derivative, 3:3'-methylene-bis-[4-hydroxycoumarin] (dicoumarin) which depresses the prothrombin levels in the blood, probably acting on the liver. It is now prepared synthetically and is very much cheaper than heparin. It has been employed in therapeutics to prevent the occurrence or extension of thrombosis. As an initial dose, 5 mgm./kgm. can be given, followed by 1.5 mgm./kgm. daily. It is somewhat slow in exerting its action, although this, when established, is rather prolonged. It is advisable to regulate the daily dosage by determining the blood prothrombin level daily, a necessity which almost completely confines its use to hospital practice. Many good reports of its action in venous thrombosis, in post-operative pulmonary embolism, and in similar conditions have appeared, with, so far at least, few toxic effects. Uncontrollable hæmorrhage, purpura, and other allied conditions have been reported in a few cases. It is advised that dicoumarin should not be employed in granulating or in ulcerative cases. In the event of excessive reduction of the prothrombin level in the blood, the best treatment appears to be transfusion with normal blood, as the use of vitamin K has not been attended with much success.

PSORIASIS—ETIOLOGY AND TREATMENT

THE cause of this disease is not yet known. There is a clinical impression, which is not yet confirmed by statistical analysis, that the number of cases of psoriasis arising in persons who have no family history of the malady and no previous history of having suffered from the eruption is increasing in Britain. This impression is worthy of confirmation or disproof, for, if confirmed, it might lead to the discovery of a new factor in the etiology. Probably toxic absorption from a focus of sepsis can be a precipitating factor, and if such a focus exists the eruption may be resistant to treatment. Therefore the patient should be investigated from this point of view and, when possible, appropriate measures taken. The question of constipation and the state of the gall-bladder should always be reviewed. In some cases in which there is no glycosuria or albuminuria, there may be evidence of a chronic cystitis; in women this is frequently overlooked and, although cystitis is unlikely to be an important factor, it may cause sufficient debility to make an eruption intractable. Psychological stress can precipitate an attack of psoriasis, and so long as this factor remains unrelieved the malady may resist treatment.

TREATMENT

General.—Stubborn cases of psoriasis are best treated in bed; this simple measure makes a considerable difference to the outlook in the majority of cases. Frequently, severe or resistant cases make better progress if given sedatives rather than traditional remedies such as arsenic, or more modern measures such as injections of mercury sulphide, although these drugs are useful in selected cases. Particularly, good sleep at night should be ensured; phenobarbitone is usually suitable for this purpose.

Treatment by dietary measures is very difficult at the present time, and few regard such measures as being more than adjuvants in therapy.

Local.—If the eruption has passed the stage of efflorescence, chrysarobin is usually the most effective local application, provided the patient's skin is not unduly sensitive. Most cases tolerate a simple ointment containing 3 per cent. of the drug, and the concentration can be slowly increased to 10 or even 15 per cent. The salve should be well rubbed into the lesions on the trunk and limbs, twice daily, until the scaly patches become white and smooth, and the surrounding skin a little inflamed, when treatment can be completed by a soothing application, such as zinc cream. The disadvantages of chrysarobin treatment are discussed in every textbook of dermatology. Dithranol ointment or paste (1 to 3 per cent.) may be used instead of chrysarobin, but many consider that it is more irritating to the skin and less effective.

For the face and delicate areas, such as the flexures and the vulva, an ointment consisting of equal parts of glycerin of starch and ointment of salicylic acid is useful. A small amount of tar can be added to this salve by mixing with it 3 to 5 per cent. solution of coal tar.

For the scalp, the following is useful:—

R							
Ammoniated mercury	..	..	..	..	..	3 per cent.	
Salicylic acid	..	..	..	..	..	3 per cent.	
Emulgent base	..	..	..	..	..	to 100	

Rub into the scalp twice daily.

In many cases in which chrysarobin or dithranol are not considered suitable, the following ointment is beneficial:—

R						
Tar ointment						
Salicylic acid ointment						
Dilute ointment of mercuric nitrate						
Glycerin of lead subacetate ointment	..	..	..	..	..	all in equal parts.

For trunk and limbs: use twice daily.

X-rays may be used by the expert to cause resolution of stubborn patches, but their use is attended by certain risks. Grenz rays are said to be safer. *Ultra-violet* rays may be used, both for active therapy and to prevent recurrences of the eruption, for there is clinical evidence to suggest that a daily exposure to these rays is beneficial in the latter respect.

A summary of this nature is hardly complete without reference to the *Goeckerman regimen*, although this is usually difficult to carry out in private practice. Briefly, the regimen depends upon the use of 2 to 4 per cent. crude coal tar in a zinc and starch paste, ultra-violet rays, oatmeal baths and autohæmotherapy.

On the first evening the lesions are covered with the paste, which is removed next morning with liquid paraffin. A thin film of the paraffin is left on the skin. The body surface is then divided into six areas and ultra-violet ray treatment is given to each, so as to produce a mild erythema. The patient then spends half to two hours in an oatmeal bath, in which the scales are removed by gentle rubbing. After drying, the paste is reapplied. The procedure is repeated daily, sufficient ultra-violet rays being given to keep the skin slightly erythematous. Autohæmotherapy (10 c.cm. of whole blood) is given at two-day intervals on five occasions. The treatment is continued until the scaling has cleared and the plaques have ceased to feel indurated; usually this takes about a fortnight.

In theory, there is risk of producing exfoliative dermatitis by these procedures, but in practice they are usually very successful. The shortage of oatmeal necessitates modification of the regimen at the present time.

R. M. B. MACKENNA, M.D., F.R.C.P.

DIURETICS I

THE ORGANIC MERCURIAL DIURETICS

IN modern practice the organic mercurial diuretics occupy such a prominent position that it is proposed to devote this article to them. A subsequent article will deal with the remaining groups of diuretics.

A large number of organic mercurial diuretics are available under proprietary names, but, as there is little to choose between them from the point of view of clinical efficiency and reliability, only one need be considered here, namely, the injection of mersalyl (B.P.). This is dispensed in 1 c.cm. and 2 c.cm. ampoules as a 10 per cent. solution to which has been added a 5 per cent. solution of theophylline. This latter addition has been made for two reasons: (a) it results in an enhanced diuretic action, due to a synergistic action between the mercurial salt and the theophylline; (b) there is evidence to show that the addition of theophylline, for some reason still not quite clear, reduces the local irritative action of the mercurial salt on the subcutaneous tissues.

METHODS OF ADMINISTRATION

The organic mercurial diuretics can be given (a) intravenously; (b) intramuscularly; (c) per rectum, and (d) orally. They must never be given subcutaneously on account of the strong irritant action which may lead to necrosis of the subcutaneous tissues.

Intravenous and intramuscular administration.—The routes of choice are the intravenous and the intramuscular, as a much better diuresis is obtained thereby than with rectal or oral administration. Personally, I prefer the intravenous route as this is the most reliable way of ensuring a satisfactory diuretic response. Many clinicians, however, prefer the intramuscular route, as it is a more simple procedure in general practice and with it there is less risk of introducing a small amount of the preparation into the subcutaneous tissues. A further practical disadvantage of the intravenous route is that, if repeated frequently, it may lead to thrombosis of the vein at the site of injection. In obese subjects, patients with anasarca, and young children, in all of whom veins may not be available for injection purposes, the intramuscular route should be used.

When the intravenous route is used the injection must be given slowly, and care must be taken to ensure that none of the solution escapes into the perivenous tissues. Should there be any evidence of such perivenous leakage, the injection must be stopped immediately and the needle withdrawn. In no circumstances should an attempt be made to reinsert the point of the needle in the vein; a fresh injection must be made into another vein. The most suitable vein to use is the antecubital in the bend of the elbow.

The buttocks are the best site for intramuscular administration, and the injection should be made deep into the muscles.

As diuresis begins soon after the injection and is usually complete within about twelve hours, injections should always be given in the morning to ensure that the patient is not disturbed unnecessarily during the night.

Dosage.—The usual dose is 1 to 2 c.cm. of the 10 per cent. solution, and this may be repeated twice weekly for prolonged periods of time. Records are now available of patients who have received regular injections of these diuretics for periods up to five or seven years without any evidence of toxicity or decreasing effectivity. The recommendation is sometimes made that the initial dose should be 0.5 c.cm., with gradual increase of dosage until the patient is receiving 2 c.cm. per injection. Unless there are special indications it is seldom necessary to proceed so cautiously.

Rectal administration.—Some of the organic mercurial diuretics are available as suppositories. These produce a satisfactory diuresis although it is never as great as that obtained with intravenous or intramuscular administration. On the other hand, they have obvious practical advantages for the general practitioner. Preliminary emptying of the rectum is necessary, and this should be obtained by giving a laxative two nights before the suppository is to be given, or an enema a few hours before inserting the suppository. There is sometimes difficulty in persuading the patient to retain the suppository; if it is retained for two hours the diuretic response is usually satisfactory. A suppository may be given twice weekly.

Oral administration is not satisfactory. Some of the proprietary preparations are available in tablet form, each tablet containing 0.8 gm., but a large number of tablets must be given, and the diuretic response is unreliable.

THE USE OF AMMONIUM CHLORIDE

The diuretic action of the organic mercurial diuretics is enhanced by the administration of ammonium chloride, itself a diuretic. There is evidence to suggest that this enhanced diuresis is not merely an additive effect, but that there may be some synergistic action in the combination of the two. As there is no particular merit in obtaining an exceptionally marked diuresis, and as ammonium chloride is an unpleasant salt to take, it should not be used routinely for this purpose. On the other hand, when the diuresis obtained with mersalyl alone is not satisfactory, then it is usually advisable to combine it with ammonium chloride. The most satisfactory way of giving ammonium chloride is in 10 grain (0.6 gm.) tablets, taken with meals. If the patient can swallow the tablets intact, and does this during a meal, there is little risk of their producing gastric irritation. Many methods of disguising the unpleasant taste of ammonium chloride have been recommended, including liquorice, but the disguise is thin and seldom effective.

When used in conjunction with mersalyl, ammonium chloride can be given in one of three ways:—(a) In doses of 20 to 30 grains (1.3 to 1.9 gm.) it is given four times a day for two days preceding, and on the day of, the injection of mersalyl; (b) continuously, in doses of 20 to 30 grains (1.3 to 1.9 gm.) thrice daily; (c) four doses, each of 20 to 30 grains (1.3 to 1.9 gm.), on the day on which mersalyl is administered.

INDICATIONS

Cardiac œdema is the main indication for the organic mercurial diuretics, and in the alleviation of this condition it is the treatment of choice, in combination with digitalis and rest in bed. Indeed, they have proved so effective that mechanical methods of removing œdema fluid, e.g. paracentesis, are seldom now required. They are also of prophylactic value in heart failure, in delaying or preventing the development of œdema. This is achieved by giving weekly injections of mersalyl to patients with threatened congestive heart failure. The diuresis in such patients, of course, is never large, but this routine administration of mersalyl does seem to help in preventing further attacks of congestive failure.

The organic mercurial diuretics are also of value in the treatment of the œdema due to *nephrosis* or the nephrotic stage of Bright's disease, but a careful watch must be kept for any evidence of renal irritation, e.g. albuminuria, hæmaturia or oliguria. In the œdema accompanying *chronic nephritis* they should be used with the utmost care. It is in these cases that it is wise to begin with an initial dose of 0.5 c.cm., and gradually increase the dose. In œdema associated with *liver disease*, e.g. cirrhosis, they are not as a rule very effective, but are well worth trying. They have also been used as part of the treatment of *Ménière's disease*. Their use in the treatment of obesity should be avoided unless there is some definite indication, e.g. congestive heart failure.

CONTRAINDICATIONS

The organic mercurial diuretics should not be given to patients with *acute nephritis*. In patients with subacute or chronic nephritis they should be used with caution. They are also contraindicated in *hepatitis* and in the hæmorrhagic diatheses, e.g., *purpura*, *hæmophilia* and *leukæmia*. An additional contraindication in the case of the suppositories is the presence of hæmorrhoids or proctitis.

TOXICITY

Much has been heard of recent years, particularly in American literature, of the toxicity of this group of drugs, and there can be little doubt that their potential toxicity has been exaggerated. Provided they are used with reasonable care, and the contraindications borne in mind, they are as safe as any other diuretic. Most of the toxic reactions that have been recorded have been due to repeated administration to a patient who had previously shown signs of toxicity or sensitivity to the preparation. Had the original warning been heeded, the subsequent accident would probably not have happened. Other accidents have been due to faulty technique, or to too enthusiastic administration, so that the seriously ill patient has been too rapidly dehydrated. It must never be forgotten that these are mercurial salts and that they are usually given parenterally. Their indiscriminate use is fraught with potential danger, but, used with reasonable care, they will cause the practitioner no anxiety.

WILLIAM A. R. THOMSON, M.D.

Part II will appear in the May number.

NOTES AND QUERIES

Subscribers are invited to make use of the service provided in this section. Answers from experts will be obtained and dispatched as soon as possible to the senders of the queries. Publication of selected and suitable queries and replies is arranged according to available space

Bilateral Thrombophlebitis

QUERY.—An unmarried woman, aged thirty-five, developed an unexplained thrombophlebitis of both lower limbs last July. Improvement has been followed, I am told, by recurrence of pain and swelling after she had been allowed up. I have seen her only once; she was in bed, and there was no marked swelling, but she complained of rather widespread tenderness. There was no discoloration. She seems quite healthy, and no trouble is detected clinically. I understand both lower limbs were X-rayed with negative results, but I do not know if this examination included the pelvis and abdomen. A blood examination has not been done. V.D. can be excluded. The spleen is not enlarged. Can you advise as to treatment and probable duration, with special reference to the use of heparin or other measures?

REPLY.—The fact that there has been bilateral thrombophlebitis and that both limbs are swollen makes it clear that the larger and deeper veins of the legs are involved, in all probability as the result of a lesion within the pelvis. This may be simply an infection which may never be traced, or it may be in the nature of pressure from a tumour, e.g. fibroids. It is essential that the pelvic organs should be examined and that an X-ray should be taken of the lumbosacral spine and pelvis. If these investigations are negative it is unlikely at this stage that the cause will be found. When sepsis does play a causative part in phlebitis its focus is usually to be found at the root of the teeth or in the sinuses.

Treatment with heparin or dicoumarol would be useless at this stage. It is likely that some oedema will persist in both legs, although an adequate collateral circulation may be established in the course of the next twelve months. If oedema does persist the wearing of suitable stockings to preserve the tissues from distension, especially around the ankles, should be advised.

A. H. DOUTHWAITE, M.D., F.R.C.P.

Massive Doses of Penicillin

QUERY.—Penicillin for systemic administration is presumably best given three-hourly in doses of about 30,000 units intramuscularly. Such frequent dosage is obviously unpracticable in a large proportion of cases in general practice, and in such circumstances it is necessary to use massive doses once or twice daily. Are massive doses of penicillin in oily suspension more effective than massive doses in aqueous solution?

In view of the practical objections to the use of the oily suspensions—the time required to warm the suspension, warm the syringe while endeavouring to keep it sterile, and clean the oil from the syringe after use, as well as the necessity to use a large bore needle—have been giving 200,000 units in aqueous solution twice daily in the treatment of abscesses and carbuncles. Is this adequate, or would the oily suspension—say 250,000 units—once daily be better?

REPLY.—Massive doses of penicillin are effective whether given in oil-wax or in water. After a dose of 500,000 units in water there is a therapeutic level of penicillin in the blood for about fifteen hours, and after the same dose in the official oil-wax mixture, penicillin can be found in the blood for twenty-four hours. Although after the oil-wax injection penicillin can be found in the blood for a longer period, it never reaches the high level which is found soon after the injection of a watery solution. It is difficult to say which is the better method of treatment. Doses of 200,000 to 300,000 units twice daily have been found to be very effective in the treatment of carbuncles as have single daily injections of 500,000 units in water or 300,000 to 500,000 units in oil-wax. As penicillin is not toxic and as the supply is now ample it is much safer to give too much than too little.

SIR ALEXANDER FLEMING, F.R.C.P., F.R.S.

Achondroplasia and Heredity

QUERY (from Malta).—Can you enlighten me on the subject of heredity and achondroplasia? What would be the advice to give to a patient contemplating marriage with the sister of an achondroplastic girl, and what are the chances of the children of such a marriage being born with the same condition?

REPLY.—Achondroplasia is a straightforward autosomal dominant. In a pedigree in which this condition occurs all individuals not themselves exhibiting the character are in fact normal. Therefore if the sister of an achondroplastic girl is herself not achondroplastic (in any degree), then she does not possess the responsible gene and therefore cannot transmit it. The achondroplastic girl must either be an instance of fresh mutation or else there must be achondroplasia in the family.

PROFESSOR F. A. E. CREW, M.D., D.Sc., Ph.D., F.R.S., F.R.C.P. (Ed.).

Early Suppurative Otitis

QUERY.—What is the best treatment for the patient—usually child or infant—who is brought to you by the parent who says "He seemed very flushed and restless yesterday and this morning, I noticed his ear discharging"? The discharge is often blood-stained. The temperature has probably already abated. Hearing may be impaired, although this is often difficult to assess in the baby. How, at this early stage, can the "chronic ear" be prevented?

REPLY.—Once the ear has become infected the immediate recovery, or the drift into chronicity, is not completely controllable by any immediate local treatment but rests in a great many cases upon the removal of the original cause of infection. The probability is that the restlessness and flushing were due to a mild or acute infection which probably caused an ascending infection from the nose or nasopharynx. Provided the ear is cleansed regularly, preferably by mopping under direct vision, the ear will in almost every case recover without impairment of hearing. If the primary infection clears up rapidly the ear will also clear up. On the other hand, should there be infected adenoids in the nasopharynx, or sinusitis resulting from the acute infection, it is likely that this will require to be dealt with before the ear can be expected to clear up completely. If the ear does not cease discharging within, say, two weeks, the probability is that there is some such condition which needs to be dealt with and therefore advice should be sought. It may be suggested, although this is slightly outside the scope of this reply, that if the child is seen in the early stages while the discharge is still serious and perhaps blood-stained, the immediate administration of penicillin by injection may go far to aid rapid recovery. The dangers, however, of using chemotherapy and thereby masking more serious symptoms cannot be over-emphasized.

I. SIMSON HALL, F.R.C.S.

smooth. The patient does not appear to be of a neurotic type; she is a non-smoker, and does not use lipstick. Treatment during the past three years has included sulphathiazole lozenges, riboflavin, liver extract by injection, ascorbic acid, and hexoestrol, the latter on the assumption that the condition might be menopausal. No benefit has resulted. I have two almost similar cases and am wondering if you could perhaps suggest some form of treatment.

REPLY.—Painful tongues frequently provide most difficult problems in diagnosis and may be most intractable to treat. Your correspondent seems to have tried most things and from his description there seems little doubt that the condition is *not* due to a deficiency disease. The fact that the papillæ are enlarged rather than atrophic would suggest some chronic irritative or infective condition. It is necessary in such a case to be absolutely certain that chronic irritation of the gums and tongue is not occurring as the result of ill-fitting dentures. Occasionally a chronic Vincent's infection, difficult to demonstrate bacteriologically, is responsible for such a condition and an intravenous injection of 0.3 gm. N.A.B. might be tried, repeated once if necessary, or a paint of arsenical solution. Such arsenicals would probably be preferable to penicillin lozenges, which may themselves be responsible for sore tongues, in spite of their effectiveness in Vincent's infections.

PROFESSOR D. M. DUNLOP, M.D., F.R.C.P.

Intramuscular Paraldehyde

With reference to the query on page 177 of the February issue, Mr. H. Grainger, Ph.C., Chief Pharmacist, the Prince of Wales's General Hospital, writes:—"It might be worth while to call the attention of your inquirer regarding intramuscular paraldehyde to an article by Marston (*Pharmaceutical Journal*, November 7, 1942, 149, 152) in which the subject was thoroughly examined. It was shown that *Cl. Welchii* could be cultured from previously infected samples of paraldehyde after heating for 10 minutes at 120° C. Paraldehyde is not a reliable antiseptic and the practice of using it 'straight from the bottle' should be deprecated, though possibly justifiable in emergency. Paraldehyde for injection should be thoroughly purified from excess acidity or peroxidized compounds by shaking out with distilled water, dried over calcium chloride, and sterilized in sealed (2 c.cm.) ampoules at 130° C. for 30 minutes. A small stock of such ampoules is always available in this Hospital."

Persistent Sore Tongue

QUERY (from S. Africa).—A European woman aged fifty, has complained of a sore tongue, off and on for the past three years, but persistently for the past seven months. There are no other symptoms except that the gums are also occasionally affected. There is no fatigue, indigestion, palpitation or dyspnoea. The patient has artificial teeth which she cleans with soap and water and soaks well before using them. Examination generally is completely negative, including blood count, Wassermann test, and urine analysis. The tip of the tongue is red and the papillæ are enlarged; the surface is not

NOTES AND QUERIES

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PRACTICAL NOTES

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gum and to allow it to dissolve slowly, swallowing the saliva containing the penicillin solution. One pastille was sucked on awakening in the morning, another before lunch, and the third on retiring at night. Ten patients who also had had acute rheumatism preceded by pharyngeal infection were used as controls. The treatment was continued daily for twelve months, all the patients, three of whom were school-children, two housemaids, two farmers, two labourers and one ex-sailor, of ages ranging from eleven to twenty-nine years, went about their ordinary vocations as usual during the treatment period. The results show that whereas in the treated group the incidence of sore throat was 3, in the untreated group it was 18, acute pharyngitis and/or tonsillitis in the treated group 1, in the control group 5; subacute rheumatism in the treated group 1, in the control group 4; an acute rheumatism in the treated group nil and in the control group 1. The advantage of penicillin pastilles as an effective alternative to the sulphonamides in the prophylaxis of acute rheumatism is that the need for blood counts to forestall toxic reactions to the sulphonamides is obviated.

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An Anti-Asthmatic Aerosol

NG a simple combined steam generator and aerosolizer which they have previously described (see *The Practitioner*, November 1945, 5, 325), S. J. Prigal *et al.* (*Journal of Allergy*, January 1947, 18, 16) report satisfactory results in the use of theophylline ethylenediamine aminophylline, cardophyllin, genophyllin) as an aerosol in the treatment of bronchial asthma. 40 patients who received this treatment, (80 per cent.) obtained relief. In some cases relief was more satisfactory than that obtained with intravenous administration of the drug, although in others the converse held true. Those who were benefited by the treatment, response occurred within a few minutes. The recommended procedure is that the contents of one ampoule of the drug (0.25 gm. in c.c.m.) is aerosolized, and if no relief is obtained within fifteen minutes after cessation of treatment the same dosage is repeated. In one patient's study of the vital capacity showed an average increase of 20.6 per cent. following the use of theophylline ethylenediamine as an aerosol. When there was evidence of respiratory infection as well as asthma, penicillin was also given as an aerosol, either alone in doses of 1,000 to 30,000 units every three hours, or combined with the theophylline ethylenediamine. The aerosolizer used is not only inexpensive, but can also be used by the patient for self-administration.

The Treatment of Peptic Ulcers

COLLOIDAL aluminium hydroxide gel was introduced for the treatment of peptic ulcers in 1934. Its advantages are that it controls gastric acidity more satisfactorily than the alkalis commonly used for this purpose, and that it does not lead to alkalosis. Among its disadvantages are the lack of uniformity in different preparations and the tendency for it to produce constipation. I. R. Jankelson (*American Journal of Digestive Diseases*, January 1947, 14, 11) finds that these disadvantages can be overcome by combining it with magnesium hydroxide. Over a period of two years he has used a combination of a colloidal aluminium hydroxide gel and 4 per cent. magnesium hydroxide in more than 150 cases of peptic ulcer. He found that this combination controlled pain and heartburn and produced no side-effects when given in a dosage of 8 c.c.m. three or four times a day. "When indicated, it can be used for long periods without the fear of alkalosis, of acid rebound or of aggravation of the constipation". The preparation is stable, although on standing some settling of the gel may occur; this is easily overcome by shaking

the bottle before use. The rather flat taste can be improved by adding a little peppermint. It is also claimed that it is suitable for the treatment of peptic ulcers by intravenous drip.

Succinyl Sulphathiazole in the Treatment of Ulcerative Colitis

As a result of their experience with 55 patients with ulcerative colitis, followed over a period averaging two years, E. N. Collins and J. S. Hewlett (*Gastroenterology*, November 1946, 7, 549) consider succinyl sulphathiazole to be a useful drug in the treatment of this condition. In 32 patients the condition was limited to the left side of the colon, and these were treated with retention enemas: 2 gm. of the powder or 4 tablets, each 0.5 gm., were dissolved in a glassful (200 c.c.m.) of warm water, and this suspension was injected per rectum by the patient at bedtime every night for two weeks. A week was then allowed to pass and then the nightly enemas were renewed for another fortnight. In the remaining 23 patients, in whom the condition involved the greater part of the colon, succinyl sulphathiazole was given by mouth; 1 gm. four times daily. This dosage was given for periods of a fortnight, each fortnight alternating with a week without treatment. In patients making favourable progress the rest intervals were gradually increased. Of the entire series, 41 (74.5 per cent.) had a complete remission of symptoms, 4 (7.3 per cent.) were improved, and 10 (18.2 per cent.) showed no improvement. Naturally, the results were even better in the patients in whom the condition was localized to the left side of the colon; 28 (87 per cent.) had a remission of symptoms.

Gynæcomastia and Vitamin Deficiency

An outbreak of gynæcomastia among American prisoners of war held in the Philippine Islands, thought to be due to a temporary upset of endocrine balance following severe prolonged malnutrition, is recorded by R. E. Hibbs (*American Journal of the Medical Sciences*, February 1947, 213, 176). Of over 500 cases in the camp, 100 were submitted to weekly examinations. Improvement followed the administration of one vitamin capsule daily (vitamin A, 5000 U.S.P. units, vitamin D, 500, vitamin B₁, 333 [1 mgm.] vitamin C, 600 [30 mgm.] and vitamin G [riboflavin] 2 mgm.). No change in sex characteristics, size of the testicles, or potency were noted, but there was transitory hypertension after the disappearance of the gynæcomastia. The raised blood pressure lasted from four to six months, and was thought to be due to adrenal dysfunction.

months' treatment there was complete disappearance of all signs of epilepsy, so that patients who had been in institutions for some years were able to resume social life. In the remaining 35 per cent. there was marked diminution in the gravity and number of attacks and also attenuation of secondary symptoms. One point of interest noted was that among male patients the suppression of the attacks did not result in the appearance of compensation phenomena, whereas in five or six of the women patients the result was less satisfactory and general traits of behaviour were aggravated, especially aggressiveness. It is stated that this was the only negative result of the treatment observed. All patients were observed during a period exceeding one year, and no secondary reactions or adverse effects on the intelligence of the patients were noted. It is stressed, however, that the treatment must be continued, regularly and methodically and without any modification, for at least five years. Several illustrative cases are recorded in detail.

Tonsillar Stumps

In a series of 285 patients who had had tonsillectomies, C. B. Sputh, Sr. and Jr. (*Journal of the Indiana State Medical Association*, August 1946, 39, 401) found 228 (80 per cent) in whom there were tonsillar stumps. In the majority of patients in whom these remnants become infected the symptoms are systemic rather than local, i.e. fatigue, loss of weight, pain in the joints or limbs. Sometimes there may be complaints of dermatological manifestations or middle-ear disease. The important diagnostic signs are tenderness in the sub-maxillary region, over the tonsillar stump and along the course of the jugular vein. Treatment consists of removal of the remaining tonsillar tissue under general anaesthesia. Results are better if infection of the teeth and gums, when present, are dealt with first. In this series no serious complications were encountered. In a few patients there was temporary loss of taste, whilst occasionally there were adhesions binding the tongue to the anterior pillar; these responded well to cutting with surgical diathermy.

Bismuth in the Treatment of Furunculosis

THE use of intramuscular injections of bismuth in the treatment of furunculosis occurring after attacks of bronchitis, influenza, or purulent sore throat, is recorded by A. Dessewffy, of Budapest (*Ars Medici*, December 15, 1946, I, 243). The course of treatment consisted of three intramuscular injections at three-day intervals.

In patients of weak constitution, and particularly in women, the initial dose was 0.75 c.cm., with two subsequent doses of 1 c.cm. each; in stronger patients, and especially in men, the initial dose was 1 c.cm., followed by two doses of 1.5 c.cm. Bismuth therapy was used only in those cases which had proved resistant to all other forms of treatment, where the furuncles were fully developed the bismuth was without action, but it prevented the appearance of fresh lesions. Of 50 patients treated, 42 were cured within a week, without recurrence, in 6 the furuncles disappeared but recurred at the end of some weeks, and 2 cases proved resistant to treatment. Cases of pyodermitis, hydradenitis, and similar conditions in which there is a relation between the disease and the furunculosis, did not respond so well, although in some cases good results were obtained. The recent increased incidence in secondary furunculosis is attributed by the author to a deficiency in vitamin F, which is present in natural fats and oils; butter and different makes of margarine contain little vitamin F, and the organism is unable to replace by synthetic means the loss of non-saturated fatty acids.

Absorption of Penicillin from the Vagina

CLINICAL evidence is now forthcoming to show that penicillin is satisfactorily absorbed from cocoa butter suppositories in the vagina. J. Rock *et al.* (*Science*, January 3, 1947, 105, 13) used such suppositories, each containing 100,000 units of penicillin, in 20 patients. The dosage in each case was 200,000 units, and the serum penicillin was determined at intervals ranging from half an hour to eight hours after insertion of the suppository. In nine non-pregnant women with vaginitis or chronic cervicitis, satisfactory concentrations of penicillin were found in the serum up to four to six hours after insertion of the suppository. All these patients obtained relief following treatment. Two of them had *Trichomonas* infections, both became symptom-free, but in one the organism was still present after treatment. In three pregnant women a few days or weeks before delivery, absorption of penicillin was unsatisfactory, but in one woman treated two to three months before delivery absorption was the same as in the non-pregnant women. In seven women to whom penicillin suppositories were given during the puerperium, absorption was "excellent". It would thus appear that penicillin is satisfactorily absorbed from the vagina and that as a suppository it has a satisfactory effect upon vaginal infections.

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Atlas of Histopathology of Skin. By G. H. PERCIVAL, M.D., Ph.D., F.R.C.P.Eo., D.P.H., A. MURRAY DRENNAN, M.D., F.R.C.P.Eo., F.R.S.Eo., and T. C. DODDS. Edinburgh: E. and S. Livingstone Ltd., 1946. Pp. viii and 494. Figures 376. Price 75s.

In this atlas the illustrations of some skin diseases, such as granuloma annulare and xeroderma lipoidica, are well chosen, whereas those of others, such as pseudoxanthoma elasticum and neurofibromatosis, fail to show the characteristic histological features. Many illustrations are missing, even those in which the principal histological changes are frequently the only means of establishing a diagnosis, and which the student would expect to find well presented in a book of this kind, e.g., Bowen's carcinoma and keratosis senilis; the important lupus erythematosus is shown in a single picture only. In contrast, undue space is allotted to rare conditions, e.g., eight pictures of nevus sebaceous, and five to keratoderma hemorrhagica. The photomicrographs in colour are made by the Finlay process with expert skill, but, even so, they often lack sufficient definition by higher magnifications. The text gives much less information on histological matters than the average textbook on

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REVIEWS OF BOOKS

Medical Disorders of the Locomotor System including the Rheumatic Diseases. By ERNEST FLETCHER, M.D., M.R.C.P. Edinburgh: E. & S. Livingstone, 1947. Pp. xii and 625. Figures 262. Price 45s.

THIS is a good book. It is an encyclopædia of those diseases, including chronic arthritis and rheumatism, which fall between the spheres of the orthopaedist on the one side and the neurologist on the other. It is a sign of the emancipation of rheumatism from specialist therapeutics and of its emergence into the general framework of current medicine. The book is adapted equally for consecutive reading or for reference. The author displays throughout sound judgment and a clarity of thought and exposition, which are shown to good advantage in such difficult chapters as "Variants of the Rheumatoid Syndrome", and "Backache and the Spine". The text is always easy to read in spite of the large numbers of original papers quoted, and is nowhere burdened by repetitions. About one-fifth of the book is written by contributors on special subjects. Prof. G. A. G. Mitchell's long section on applied anatomy is of outstanding merit. Dr. Copeman writes clearly on fibrositis, and Dr. Donald Hunter, perhaps too briefly, on medical diseases of bone. The publishers have produced a handsome volume on good paper, with excellent illustrations always well placed in relation to the text. This book deserves a large sale. Physicians and investigators specializing in rheumatism should have it on their shelves. Any general practitioner who can devote enough time to its study will gain a wide, fair and wise view of this important branch of medicine which no undergraduate course or standard textbook has yet encompassed.

The Chemistry of Anaesthesia. By JOHN ADRIANI, M.D. Oxford: Blackwell Scientific Publications Ltd., 1946. Pp. viii and 530. Figures 45. Price 35s.

IT may be said without hesitation that this book will undoubtedly become a classic work of reference for both clinicians and research workers in the field of organic chemistry (Part II) and biochemistry (Part III) in their relation to anaesthesia. It contains a vast and authoritative store of information on these subjects and is written clearly and concisely with excellent diagrammatic illustrations to elucidate the text. Part I of the three sections into which the book is divided deals with inorganic chemistry in relation to anaesthesia and includes a compre-

hensive account of the physical laws of gases and their application in clinical anaesthesia. The appendix contains useful metric conversion tables, and the entire production conforms to the usual high standards of Blackwell's series of scientific publications.

Shock Treatments and other Somatic Procedures in Psychiatry. By LOTHAR I. KALINOWSKY, M.D., and PAUL H. HOCI, M.D. Foreword by Nolan D. C. Lewis, M.D. London: William Heinemann (Medical Books) Ltd., 1946. Pp. vi and 294. Price 21s.

THIS excellent handbook will be of great service to the specialist personally engaged in the treatment of psychiatric patients along physical lines. It contains two large sections on insulin shock treatment and the convulsive therapies of which the chapter on insulin is the better balanced and more satisfactory. It is in the two fields that the authors are acknowledged experts. These chapters are succeeded by much shorter and more cursory accounts of other therapeutic methods, such as continuous sleep, fever therapy, refrigeration therapy, and electric narcosis. Finally, there is a short chapter on prefrontal leucotomy, and the book is concluded by a discussion of theoretical considerations. On the two main subjects, insulin and convulsion treatment, there is a very full account of the literature, and a summary of the views of numerous authorities on minor aspects of treatment, and prognostic implications. This is reflected in the 38 pages of bibliography at the end of the book. Thus as a source of reference in this field the book serves a most useful function. On the other hand, the lack is sometimes felt of a more positive statement of the authors' own experience, and the reader in search of direction and guidance may feel disappointed.

Pharmaco-Therapeutic Notebook. By H. W. TOMSKI, M.P.S. London: Baillière, Tindall and Cox, 1946. Pp. viii and 286. Price 15s.

A HEAVY responsibility rests on the pharmacist and he is likely to discharge his duties with greater safety and efficiency when he has an elementary knowledge of the therapeutic value of the drugs which he handles. The author has set out to supply this information and his book is well planned and clearly written. The author states that "these summaries and classified notes

should aid the medical student in his studies . . ." This may be so, but it must be emphasized that the book is a notebook for pharmacists and in no sense a textbook of pharmacology. In future editions it would be helpful to include in the index the well-known proprietary names of drugs which have acquired the status of official remedies. The words doryl, luminal and cardophylin, for example, do not appear; and carbachol is classified as an anti-malarial.

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NEW EDITIONS

A Textbook of Midwifery, by WILFRED SHAW, M.D., F.R.C.S., F.R.C.O.G., in its second edition (E. & A. Churchill Ltd., 21s.) contains a number of additions representing advances which have taken place during the four years that have elapsed since the appearance of its predecessor: in the chapter devoted to abnormalities of the foetus a section on erythroblastosis and the rhesus factor has been added; the sulphonamide drugs, and particularly their use in puerperal sepsis; penicillin, and its value in the treatment of gonorrhoea, syphilis and puerperal sepsis, are among the new features of this well-produced and richly illustrated new edition.

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NOTES AND PREPARATIONS

NEW PREPARATIONS

JOHNSON'S BABY LOTION is a smooth, white, oil-in-water emulsion of medicinal grade mineral oils and lanolin, homogenized under pressure of over 1,000 lb. to provide extreme dispersion. In order to minimize the danger of infection, a non-irritant antiseptic, 0.04 per cent. of 8-hydroxyquinoline, has been added, to inhibit the growth of surface bacteria. The emulsifying agent in the lotion is stated to be bland and non-hydrolyzing, non-toxic, non-irritating and cannot turn rancid. The lotion is issued in bottles, price 2s. 6d. by Johnson & Johnson (Gt. Britain) Ltd., Slough.

LIQUID DERBAC (DDT 2 per cent., naphtha 15 per cent., emulsifying agent 5 per cent., water 78 per cent.) has been used with success in the treatment of a large series of cases of pediculosis capitis (*Brit. med. J.*, 1946, ii, 263). The method of treatment is stated to be rapid and easy; the lice were killed in about half an hour, and no intolerance was noted in uncomplicated cases. The manufacturers of Liquid Derbac are the Pure Products Ltd., Colwick, Nottingham, from whom further particulars can be obtained.

NEW APPARATUS

THE Belclere Model M.A.3 hearing aid is operated entirely from the electric supply by plugging in and is suitable for use on 200-250 v. alternating current mains. The amplification is stated to be sufficient to render the instrument suitable in severe as well as slight cases of deafness, and the electricity consumption is exceedingly small—one hundred hours use for one unit. Other advantages claimed are a variable pre-set tone control, fitted for adjustment to individual needs, the instrument is small and compact with a wide sound range, and there is no risk of shock to the user. The price of the Belclere Model M A 3 is 28 guineas. The manufacturers are John Bell & Croyden, 117 High Street, Oxford.

THE DEEDON INHALER MODELS "C" and "D", are to be fitted with a 2 ft length of rubber tubing with valve attached, which when fitted to the rubber bulb can be easily operated by a nurse or other attendant without movement of the face mask and without fatigue to the patient. The rubber tubing with valve will be forwarded free of charge on request from those who have previously purchased a Deedon inhaler. A note on the dosage of penicillin for inhalation has been issued by the manufacturers—"For manual administration (i.e., by means of the rubber bulb provided) suitable daily treatment

consists of 100,000 units of penicillin dissolved in 1.5 c.cm. of sterile normal saline solution of which 0.5 c.cm. is inhaled three times daily. To minimize contamination doctors are recommended to prescribe 5 x 1.5 c.cm. phials, each containing 100,000 units of penicillin dissolved in sterile normal saline. Each phial is sufficient for one day's treatment: 0.5 c.cm. can be administered manually in about ten minutes. So that blockage of the syphon by deposition of solid penicillin from droplets of solution left in the syphon may not occur, instruction should be given to patients to place a small quantity of water in the reservoir at the conclusion of each inhalation, and to squeeze the rubber bulb briskly about a dozen times". The manufacturers of the Deedon Inhaler are the Moore Medicinal Products Ltd., 1 Queen's Terrace, Aberdeen.

POSTGRADUATE LECTURES

A course of postgraduate lectures by experts in surgery, anaesthesia, oto-laryngology, and orthopaedics is being given at the Royal College of Surgeons during April and May. Elsewhere in this issue (p. viii) there is published a detailed list of these important lectures, with the names of the lecturers. The fee for each course is £5 5s. od., a reduction to £3 3s. od. being made in the case of Fellows and Members of the College and Licentiates in Dental Surgery. Applications should be made to the Assistant Secretary, Royal College of Surgeons, Lincoln's Inn Fields, London, W.C.2.

DIABETIC TRAINING AND CONVALESCENCE

SPECIALIZED convalescent facilities are now available for diabetic patients: for men at the British Red Cross Convalescent Home, Burley-on-the-Hill, Oakham, Rutland, and for women and children at St. Mary's Convalescent Home, Birchington-on-Sea, Kent. The charge is 4 guineas weekly, and for children 5 guineas, with the provision of special reductions to voluntary authorities and individual cases. Special training in the diabetic regime and particular care to diets are features of the Homes. Full particulars can be obtained from the Diabetic Association, 9 Manchester Square, London, W. 1.

The contents for the May issue which will contain a symposium on "Diseases of the Eye," will be found on page LXIV at the end of the advertisement section

Binding cases—It is regretted that binding cases are temporarily unavailable owing to shortage of book cloth, due to production difficulties

MODERN VIEWS ON THE CAUSATION OF HYPERTENSION

BY CLIFFORD WILSON, D.M., M.R.C.P.

Professor of Medicine, University of London; Director of the Medical Unit, London Hospital.

WHEN, 120 years ago, Richard Bright made his observations on diseases of the kidneys he noted in some patients that during life the pulse was hard and after death the heart was hypertrophied. Not until 60 years later was it discovered by Allbutt that in the majority of patients with high blood pressure the disease may be observed to run its whole course without any clinical indication of kidney disease. Whatever the fundamental causes may be, this clinical subdivision into "essential" and "renal" hypertension has been and will remain of signal value in assessing prognosis and deciding the treatment of the patient. During the past ten years experimental workers—pathologists, biochemists and physiologists—have made a many-sided attack on the problems of hypertension; although they have uncovered many new facets of renal physiology, the genesis of human hypertension is still controversial and no certain effective therapy has been devised.

THE MEANING OF HYPERTENSION

Recently the expressions "hypertensive heart disease" and "hypertensive heart failure" have passed into common use, so that the student may be in danger of regarding high blood pressure as a cardiac abnormality rather than as a disorder of function comparable with dyspnoea or gastric pain. The present-day trend, however, is to think of circulatory disturbances less in terms of cardiac signs, and more in relation to cardiac output, arterial pressure, venous pressure and peripheral resistance. The different types of hypertension and the changes in the systolic and diastolic pressures can be understood only with reference to these variables. The peripheral resistance, largely maintained by arteriolar tone, is essential for the conversion of the heart's intermittent action into a continuous flow through the capillaries. The most common form of hypertension is due to an increase in arteriolar resistance. In such patients the cardiac output is normal and the peripheral flow is maintained by an increase in the systolic and diastolic pressures produced by the heart. In healthy individuals the larger (musculo-elastic) arteries are stretched during cardiac systole and their elastic recoil during diastole helps to maintain the diastolic pressure and the peripheral blood

flow. If, owing to degenerative changes, the arteries become more rigid, this accessory pump is less effective and the heart must produce a higher systolic pressure to maintain the peripheral blood flow. Therefore in elderly subjects it is common to observe a high systolic with a normal, or only slightly raised, diastolic pressure. In other patients, systolic hypertension may be associated with a low diastolic pressure, and this occurs whenever excessive vasodilatation produces a too rapid emptying of the arterial system during diastole. Such is the case, for example, in thyrotoxicosis, severe anæmia, or in the presence of an arterio-venous shunt. The same state of affairs will arise when the excessive emptying is due to reflux of blood into the heart owing to aortic valve incompetence. In less severe instances the systolic pressure may be sufficient to maintain a normal blood flow without reduction in peripheral resistance, and the diastolic pressure may be unchanged. A temporary increase in cardiac action, such as occurs during nervous or emotional strain, may raise systolic pressure and peripheral flow with little or no change in diastolic pressure. Therefore in speaking of hypertension we are not concerned merely with a sphygmomanometer reading but with disturbances of circulatory function as varied in causation as are disorders of cardiac rhythm. Combinations of the above types of hypertension are not infrequent; thus increased arteriolar resistance, with elevation in diastolic pressure, may coexist with increased rigidity of the larger arteries, or with thyrotoxicosis. In general, the gravity of the hypertensive state is proportional to the height of the diastolic pressure, and the discussion which follows is chiefly concerned with the common disorders, essential hypertension, and high blood pressure arising in the course of renal disease; in these conditions the fundamental disturbance is an increase in peripheral resistance, and the diastolic pressure is raised.

THE NATURE OF THE INCREASED PERIPHERAL RESISTANCE

If the circulation be envisaged as a closed system in which the cardiac pump acts against a variable resistance, a rise in arterial pressure might be caused by increase in cardiac output, in blood viscosity or in peripheral resistance. The first two possibilities can be excluded in uncomplicated hypertension, so that increase in the peripheral resistance is the main consideration. From determination of the pressure gradient at different levels in the arterial tree it has been shown that this increase in resistance occurs chiefly in the arterioles. A more difficult problem is to decide whether the vascular narrowing is uniform throughout the body or differs in degree in different organs. This question has been discussed in detail by Pickering (1943). A disproportionate increase in peripheral resistance in one area would involve a corresponding reduction of blood flow, and this in turn (the cardiac output remaining constant) would involve an increase in blood flow in other parts of the body. Goldring and his colleagues (1941), measuring renal blood flow by diodrast clearance, conclude that in the majority of cases of essen-

hypertension total blood flow through the kidney is reduced. This indicates that the peripheral resistance is increased in the kidney to a greater extent than in other organs. In voluntary muscle, on the other hand, blood flow appears to be increased, and in the rest of the body it is probably unchanged. Thus it may be said that in essential hypertension increase in peripheral resistance is generalized but is more severe in the kidney than elsewhere.

The next question concerns the state of the narrowed arterioles. Is the narrowing due to organic disease and therefore irreversible, or is it a form of heightened vasoconstriction? The lability of the blood pressure in hypertensive disease suggests the latter, and indeed experiment has shown that the blood vessels in these patients are capable of vasodilatation and give normal responses to physiological stimuli, such as reflex vasodilatation (produced by heating distant parts) and reactive hyperæmia following vascular occlusion. Organic narrowing of the arteries and arterioles in various organs is, of course, found in many patients, but this is patchy in distribution and probably contributes little to the increased vascular resistance. Similar organic changes, as Allbutt pointed out, are frequently present in elderly subjects without hypertension. There is a possibility, which will be discussed later, that severe *renal* vascular lesions may play a rôle in the maintenance of high blood pressure. If then the increased resistance is due to heightened vasoconstriction we may ask whether this is due to excessive sympathetic tone, or to a circulating pressor substance acting directly on the arterioles, or to a heightened susceptibility of the blood vessels to normal vasoconstrictor stimuli? There is at present no satisfactory answer to this problem. Sympathetic hypertonus can probably be ruled out in patients with chronic hypertension, for experiment has shown that removal of sympathetic vasoconstriction causes no disproportionate increase in blood flow in such cases by comparison with normal individuals. The next alternative, that of a circulating pressor substance, brings us to the subject of experimental hypertension, from which has been derived most of the new knowledge in this field.

EXPERIMENTAL RENAL HYPERTENSION

Goldblatt and his colleagues (1934) opened a new phase in the study of high blood pressure by their pioneer experiments on the production of hypertension in animals. By partial constriction of the renal arteries in dogs they obtained a persistent elevation of blood pressure; this was observed in the absence of any discoverable structural damage in the ischæmic kidneys and without any deterioration of renal function as measured by the tests in common use.

Subsequently, experimental renal hypertension has been produced by numerous devices, including partial excision of the kidneys, ureteric obstruction, constriction of the kidney in a cellophane membrane, and experimental nephritis. In the rat it has been shown that persistent and severe hyper-

tension may follow unilateral renal artery constriction, the opposite kidney remaining untouched. These different procedures, it may be assumed, have a common basis in the production of renal ischæmia. Furthermore, it has been shown that following constriction of the renal artery both renal blood flow and renal arterial pressure are reduced.

These experiments provided for the first time a technique for studying the genesis of renal hypertension and the results have recently been reviewed by Blalock (1940) and Goldblatt (1947). The first step was to investigate the rôle of the sympathetic nervous system. It has been conclusively shown that the rise in blood pressure following renal artery constriction is independent of the nerve supply to the kidney, since it occurs after constricting the renal artery of a kidney with all its nervous connexions severed, and even when the organ is transplanted to the neck. The increased arteriolar tone in the rest of the circulation is likewise independent of nervous impulses since hypertension may still be produced after removal of the sympathetic nerves to the trunk and limbs. The immediate result of this exclusion of a nervous mechanism was a renewed search for a pressor agent derived from the kidney. Such a substance had been isolated in 1898 by Tigerstedt and Bergmann, and was given the name of *renin*. They suggested that this principle might be responsible for hypertension in renal disease but, for reasons which do not now surprise us, they were able to achieve little more than a description of its physiological behaviour. Their results have been confirmed and elaborated by recent workers and it is now established that the changes in the circulation which follow injection of renin closely resemble those produced by chronic hypertension both in animals and in man.

Further researches, particularly by Page and his colleagues, have revealed that renin has no direct pressor effect but that it possesses the properties of an enzyme and acts on a fraction of the plasma globulin to produce the active pressor agent. The latter has been termed *hypertensin* (angiotonin) and its globulin precursor *hypertensinogen*.

These investigations have provided on the one hand, a simple method for producing renal hypertension by a process which might be expected to occur in most forms of renal disease, and on the other hand, a chemical system with pressor functions closely resembling induced or naturally occurring hypertension. The remaining link is the demonstration that high blood pressure in the experimental animal and in man is accompanied by hyperactivity of the renin pressor mechanism. The evidence for this is so far fragmentary and unconvincing. It has been claimed that in dogs, extracts of the ischæmic kidney have a more potent pressor action than extracts of normal kidney, and that venous blood from the ischæmic kidney has a higher renin content than normal; yet the transfusion of blood from hypertensive into normal animals has not been shown to produce a pressor effect. In man, no correlation has been achieved between renin production and

hypertension. The results of several workers suggest that all forms of hypertension cannot be explained satisfactorily on this hypothesis and that nervous or extra-renal factors may come into play. Yet in spite of the inconclusive nature of the evidence, the strong indications of a humoral mechanism in hypertension together with the appropriate physiological effects of renin on the circulation, make the renin hypothesis the most acceptable at the present time.

THE KIDNEY AND HYPERTENSION IN MAN

It has been seen that so far there is no direct evidence that the renin mechanism is responsible for high blood pressure in man. It remains to discuss how far a parallel can be drawn between experimental hypertension in animals and the human disease. There are two main groups to be considered—primary renal disease with high blood pressure, and essential hypertension.

In *chronic kidney disease* the blood pressure in the majority of patients rises at some stage; hypertension almost invariably develops in nephritis, and may also be observed in pyelonephritis, hydronephrosis, renal tuberculosis and congenital cystic kidney. In all these conditions it seems likely that the mechanism may be the same as in the experimental renal hypertension of animals, that is, a result of renal ischæmia. The similarity is strengthened by the occasional discovery of hypertension associated with unilateral renal disease in man and curable by removal of the diseased kidney.

In *essential hypertension* the interpretation is less clear. The great majority of cases have minimal structural changes in the kidney, although it is usual to find some degree of fatty hyaline degeneration of the arterioles. Goldblatt's observation that persistent elevation of the blood pressure could be produced in dogs in the absence of structural renal damage led him to the conclusion that the mechanism of production of essential hypertension was the same as that of the experimental form. He believed that the rôle of the clamp in producing renal ischæmia was played by arteriolar changes in the kidney. The difficulty in accepting this explanation is that renal arteriolar lesions are extremely variable in essential hypertension; furthermore, their extent and severity appear to increase with the duration of the hypertension. This supports the view that the hypertension precedes the organic arterial changes rather than the reverse. As Ellis (1942) has said: "If the presence of arteriosclerosis in the kidneys of patients with essential hypertension is to be expected as a result of the hypertension, it cannot be convincingly advanced as the cause. The problem still remains open and the evidence that essential hypertension is due to primary renal vascular lesions is at present insufficient. It is quite possible, of course, that the mechanism of production of essential hypertension is renal ischæmia, but if this is so it seems more probable that the renal ischæmia is at first functional, being due

tension may follow unilateral renal artery constriction, the opposite kidney remaining untouched. These different procedures, it may be assumed, have a common basis in the production of renal ischæmia. Furthermore, it has been shown that following constriction of the renal artery both renal blood flow and renal arterial pressure are reduced.

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by signs of renal damage, but in whom the disease subsequently runs a rapidly progressive course to death in uræmia. The recognition of this malignant form of essential hypertension has been delayed chiefly because the histological picture in the kidney—so-called chronic interstitial nephritis—was difficult to distinguish from that of a true chronic nephritis. Recently, experimental evidence has been obtained (Wilson and Byrom, 1941) that the histological features common to these conditions, and occurring in varying degree in the majority of cases of chronic Bright's disease, may arise as a result of a severe hypertension independently of any toxic or inflammatory process. This histological picture consists of focal fibrosis of the kidney and tubular atrophy with acute and chronic vascular and glomerular lesions. The essential features are necrosis of arterioles and glomeruli and endarteritis of small arteries. The experimental production of these changes in animals has established that obstructive organic changes in the renal arterial system can result from hypertension. This provides a likely explanation for the continued and progressively increasing hypertension frequently encountered in chronic Bright's disease, since the vascular lesions caused by the hypertension may presumably cause further renal ischæmia, thereby leading to a vicious circle in which the high blood pressure is perpetuated or aggravated.

In both essential hypertension and in primary renal disease this acceleration of the disease process may culminate in a "malignant termination" with papillœdema and retinal exudates, encephalopathy, cardiac asthma and rapidly progressive renal insufficiency. It is a common observation that when this phase is approaching, the high blood pressure, previously labile, becomes fixed and may even rise to higher levels in spite of prolonged rest in bed and the advent of severe heart failure. Whilst the cause of this fixation is not known it might well be accounted for by a change from functional to organic renal ischæmia following the production of hypertensive vascular lesions. These observations provide a rational basis for the treatment of hypertension by sympathectomy in so far as this procedure may prevent or reverse the malignant transformation. In early cases of malignant hypertension life may be considerably prolonged thereby even though the blood pressure remains at a high level. In patients with chronic nephritis it is occasionally possible to observe a steeply rising blood pressure before renal deterioration sets in; at this stage sympathectomy may be successful in preventing the vicious circle and in delaying the onset of hypertensive renal changes and uræmia.

From the etiological aspect it is important to distinguish two modes of development of the malignant form of essential hypertension. Very occasionally it follows a long-standing benign hypertension and may then be regarded as arising in a similar manner to the malignant termination in chronic renal disease. In the usual case, however, there is no evidence of previous long-standing hypertension and the disease has been observed to

to some extra-renal factor, and is only later aggravated by renal arteriosclerosis". It is apparent that there is no experimental counterpart of essential hypertension in man.

The view that some extra-renal factor may produce the initial renal ischaemia in essential hypertension has no direct support. It is, however, noteworthy that tumours producing overactivity of the anterior pituitary or suprarenal cortex frequently give rise to high blood pressure and that hypofunction of these glands is characterized by hypotension. Attempts to demonstrate any consistent histological change in the pituitary or suprarenal cortex in essential hypertension have been unsuccessful. There is some evidence that the suprarenal cortex may play a part in the renin mechanism, and in particular that it is concerned in maintaining the production of hypertensinogen. These observations are suggestive but at present they offer no more than an attractive lead to the possible endocrine origin of essential hypertension.

At this point it may help our perspective to turn from the analytical approach to some well-established facts about the incidence of the disease. There is first its well-recognized hereditary association. Ayman (1934), studying 1,524 members of 277 families, found that when neither parent had hypertension 3.1 per cent. of the children developed high blood pressure, whereas when one or both parents had hypertension the incidence in the children was 28.3 per cent. and 45.5 per cent., respectively. Furthermore, in view of the marked variations in occupational and racial incidence, it is difficult to dismiss the idea that nervous strain predisposes to the development of the disorder. In women, high blood pressure arises more frequently than in men and its course tends to be more protracted. Finally, hypertension is an extremely common condition and its incidence rises rapidly after the age of forty. Master *et al.* (1943), in a survey of 15,000 individuals, found blood pressures of 150/90 mm. Hg or more in 26 per cent. of males in the fourth decade, 41 per cent. in the fifth, and 56 per cent. in the sixth; in women the variation was similar but the incidence higher. These facts emphasize that essential hypertension is a social as well as an individual problem; they also indicate that the issue is much larger than a simple disturbance of renal blood flow.

MALIGNANT HYPERTENSION

The recognition in the past few years of a malignant form of essential hypertension has helped to clarify one of the most confusing chapters of Bright's disease and has indicated the manner in which structural renal changes might contribute to an established hypertension. The term "hyperpiesia" was applied by Allbutt to a condition in which high blood pressure was unassociated during life with signs of renal involvement. The wide acceptance of his teaching obscured for many years the existence of a small group of patients who exhibit severe hypertension at first unaccompanied

THE SURGICAL TREATMENT OF HYPERTENSION

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At the present time it is not possible to lay down precise indications for surgical intervention in hypertension. This uncertainty derives from lack of complete information regarding the etiology and pathology of essential hypertension—the type in which operation is sometimes employed as a therapeutic measure—because for lack of this information all the various operations which have been tried during the last twenty-five years must be regarded as empirical. Whatever the type of operation, the issue is further complicated by the variability of results according to the criteria employed in assessing them; a matter which will be dealt with in more detail later.

The procedures which have been used have all been designed to deal with factors which from time to time have been considered to be important in the pathogenesis of essential hypertension; as will have emerged from the preceding article, none of the hypotheses which led to the selection of these factors can now be considered tenable. Yet they must be considered briefly, since they help to explain the scope of the modern operation.

(1) *The hypothesis that by interrupting the vasoconstrictor nerves to the splanchnic area, vasodilatation would be produced in a large area which would result in a fall of blood pressure.*—Vasoconstrictor nerves to the vessels in the viscera in the abdomen traverse the two greater and two lesser splanchnic nerves, those to the vessels of the pelvic viscera traverse the superior hypogastric plexus (presacral nerve). The origin of these nerve strands is shown diagrammatically in fig. 1. In the path of the splanchnic nerves there is, on each side, the celiac (semilunar) ganglion, whilst the superior hypogastric plexus divides into the two hypogastric nerves, each of which joins a hypogastric ganglion; the celiac and hypogastric ganglia may house the cell stations between the pre- and post-ganglionic relays of the vasoconstrictor pathway. In accordance with present views, interruption of this pathway is most efficacious if made through the pre-ganglionic strands, the ganglia being left intact. Merely to divide the greater splanchnic nerves at their junctions with the celiac ganglia would leave intact thoracic branches of these nerves passing medially to the aortic plexus, which also furnishes branches to the celiac ganglia: thus the operation must be extended into the thorax, so that the splanchnic nerves and their trunks of origin, the thoracic sympathetic chains, are removed from as cranial a level as can be accomplished. Since pre-ganglionic fibres do not leave the spinal cord below the level of the second lumbar segment, interruption of the vasoconstrictor

run its whole course within six months of the rise in blood pressure. In patients dying in the early stages from some extra-renal cause arterial changes in the kidney may be extremely slight. This is consistent with the view, already put forward on the basis of experimental observations, that in this condition the renal vascular lesions are the result and not the cause of the malignant hypertension. We are led to the conclusion that in this disorder, as in benign hypertension, the renal ischæmia is at first functional. There is no clue to the factor which determines the malignant character of the hypertension: as no excessive production of pressor substances has been demonstrated it can at present only be attributed to an excessive individual response of both the renal and extra-renal arterioles to an unknown vaso-constrictor stimulus.

CONCLUSIONS

An attempt has been made to extract from the large field of experimental work the least controversial evidence and to relate it to the clinical and histological features of hypertensive disease. Admitting that no unassailable conclusion can be formed on the origin of essential or renal hypertension, the evidence may be summarized thus:—Renal ischæmia is the probable cause of the high blood pressure and leads to a generalized increase in peripheral resistance through a humoral mechanism. In primary renal disease, organic changes cause the ischæmia; in essential hypertension the ischæmia is at first functional, the primary stimulus being probably extra-renal. In both forms the hypertension may lead to renal vascular changes which aggravate the ischæmia so that the blood pressure progressively rises and becomes fixed at a high level. Whatever may be the intimate nature of the pressor mechanism its activation in the individual is largely determined by genetic and environmental factors.

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fibres to the pelvic viscera can be secured by removal of the upper two lumbar sympathetic ganglia and the intervening chain.

(2) *The hypothesis that by interrupting the nerves to the adrenal glands, the output of adrenaline will be reduced.*—The adrenals are supplied by branches of the semilunar ganglia.

(3) *The hypothesis that by interrupting the nerves to the renal vessels, renal ischaemia will be diminished as a consequence of vasodilatation.*—In addition to branches from the semilunar ganglia, the kidneys are supplied by the least splanchnic nerves, when they are present. To accomplish object (3) the operation must include removal of the twelfth thoracic ganglia.

The anatomical scope of an operation designed according to these three hypotheses is also shown in fig. 1, the nerves to be removed being indicated in the stippled areas.

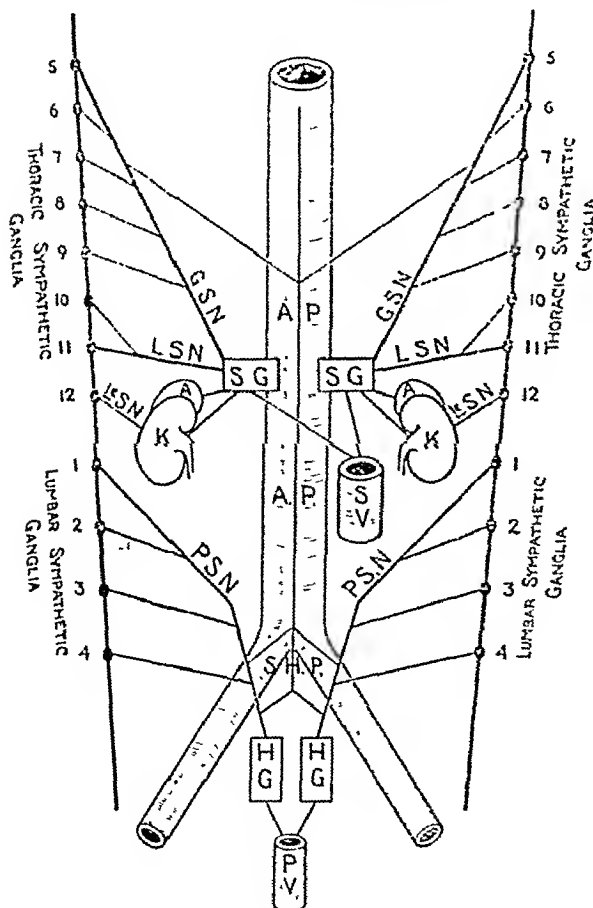


FIG. 1.—The anatomical basis of operation for hypertension. A.P.=aortic plexus; G.S.N.=greater splanchnic nerve; L.S.N.=lesser splanchnic nerve; Le.S.N.=least splanchnic nerve; S.G.=semilunar ganglion; A=adrenal; K=kidney; S.V.=splanchnic vessels; P.S.N.=pelvic splanchnic nerve; S.H.P.=superior hypogastric plexus; H.G.=hypogastric ganglion; P.V.=pelvic vessels.

SELECTION OF PATIENTS FOR OPERATION

If interruption of vasoconstrictor fibres to the vessels of an area or of an organ is to result in vasodilatation, the vessels must in fact be capable of dilating. It may be possible to determine this directly in a superficial area, or it may be necessary to rely on the results of tests of visceral function, or other evidence of the presence of irreversible organic changes in the vessels

which it is desired to modify. It will be noted that tests of suitability for operation designed on these lines serve to exclude unsuitable cases, but do not necessarily indicate those patients who will benefit from operation.

(1) *The age of the patient.*—With increasing age, arteries and arterioles tend to lose their resilience as the result of early organic changes in their walls and, although the first change observed in essential hypertension is hypertrophy of the media, other changes of a degenerative nature gradually supervene, so that it is natural that an upper age limit should be set to attempts to produce widespread vasodilatation by sympathectomy. Most surgeons fix an upper arbitrary limit of fifty years of age, and clinical experience indicates that this figure serves well enough if it is integrated with the other clinical data. With experience, it is occasionally possible to offer operation with a guarded prognosis to patients who are a little older; the oldest patient in my own series who obtained any benefit from operation was fifty-three years of age. It is obvious, too, that the younger the patient the less likely it is that vessels will have undergone irreversible organic changes, and in practice it is unwise to operate upon patients who are older than forty without very careful appraisal of the clinical data in each individual case.

(2) *The cardiovascular system.*—(a) The blood pressure: It is necessary to have evidence that the blood pressure, and particularly the diastolic blood pressure, is labile. Information on this point may be obtained in a number of ways: thus the blood pressure may fall during a period of rest in bed, and it may be found to be lower during natural sleep. The most generally applicable test is to secure sleep, or at least tranquillity, by the administration of a drug, and to observe the blood pressure while the patient is under its influence. There is a choice of drugs, but the one usually employed is sodium amytal, and this method has the advantage that it may be carried out quite easily in the patient's own home.

Three grains (0.2 gm.) of sodium amytal are given at hourly intervals for three doses, that is to a total of 9 grains (0.6 gm.), and observations on the blood pressure are made at half-hourly intervals from the second to the fifth hour after the beginning of the test. When the blood pressure is labile, a considerable fall in systolic pressure is to be expected, but most attention should be paid to the fall, if any, in diastolic pressure. It is customary to adopt a level, again arbitrary, of 100 mm. Hg, and to reject as unsuitable for operation those patients whose diastolic pressure does not fall below this level as the result of the sedation. Suitable and unsuitable types of response are shown in fig. 2 and 3.

It must be emphasized that although the diastolic blood pressure may fall below 100 mm. Hg on sedation, this does not necessarily guarantee a satisfactory post-operative response. On the whole it is found that the less the habitual diastolic pressure has exceeded 100 mm. Hg, the more satisfactory the result from operation; patients with high and fixed diastolic pressures are not suitable for operative treatment.

One type of hypertension requires further discussion, i.e., that in which

the blood pressure of a young person is found to be elevated only intermittently. There is some evidence that in such cases the pressure readings

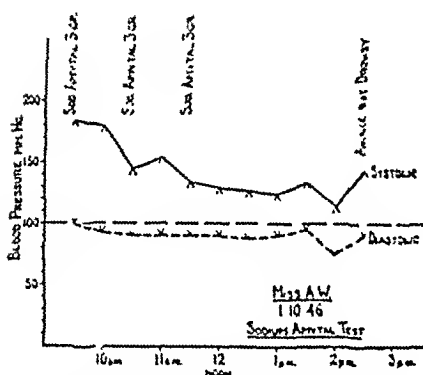


FIG. 2.—Sodium amytal test: type of response in which operation is indicated.

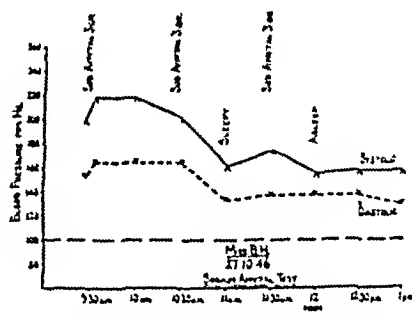


FIG. 3.—Sodium amytal test: type of response in which operation is contraindicated.

ultimately become continuously elevated, and it might be argued that this type is suitable for operation on the ground that denervation will prevent the stabilization of blood pressure at a high level. At present there does not seem to be sufficient justification for including these cases of intermittent hypertension in the category of those suitable for operation.

(b) The cardiac function: Moderate enlargement of the heart should not be regarded as a contraindication to operation, because hypertrophy of the left ventricle is the physiological response to the increase in blood pressure. In cases of longer standing, the presence of congestive heart failure is an absolute contraindication to operative procedures, and it is unwise to accept for operation patients who have a history of anginal attacks. The electrocardiogram may give valuable information on this point, but inversion of the T wave alone is not an absolute contraindication to operation.

(c) The so-called encephalopathies: The occurrence of transient attacks of hemiparesis or hemianopia, with or without aphasia, and disturbances in the fields of vision, do not contraindicate operation provided that careful examination shows that residual symptoms and signs are not present.

(3) *Ophthalmoscopic examination*.—Many investigators grade the severity of hypertension by the appearances on ophthalmological examination. The classification generally used is as follows:—

Grade I: Arteriolar constriction only.

Grade II: Arteriolar constriction and tortuosity with constriction of the veins at the points where they are crossed by arteries.

Grade III: As Grade II, but with hæmorrhages and exudates.

Grade IV: Papillœdema with hæmorrhages and exudates.

Papillœdema indicates the malignant form of hypertension and is an absolute contraindication to operation. In general, the fundal changes reflect

the intensity of the other clinical features in essential hypertension, and therefore the most hopeful cases are those in which ophthalmological examination discloses the changes characteristic of grades I and II.

(4) *Renal function.*—Gross impairment of renal function as reflected in a high blood urea level is an absolute contraindication to operation, and 50 mgm. per cent. is generally accepted as the highest allowable figure. In addition to estimations of blood urea, the ability of the kidneys to concentrate and to excrete urea is tested because moderate impairment of renal function may be present although the blood urea nitrogen is within normal limits. The test employed is the urea range test which, like the sodium amylal test, has the advantage of being practicable in the patient's own home.

During the afternoon fluids are restricted; at 9 p.m. the bladder is emptied and the patient is given 15 gm. of urea dissolved in 100 c.cm. of water. All urine passed between 10 p.m. and 6 a.m. is kept and measured. At 6 a.m. two pints of tea or other suitable liquid are given, and the bladder is emptied at hourly intervals for three or four hours. The total night specimen and each morning specimen are tested separately. If renal function is satisfactory, the night specimen should show a specific gravity of 1020 or higher and a urea content of 3 gm. per cent. or more, whereas the morning specimen should reflect a marked diuresis in a specific gravity of about 1010 and a urea content of under 2 gm. per cent. Examples (1) and (2), which follow, refer to the patients whose sodium amylal tests are illustrated in fig. 2 and 3 (p. 464), respectively:—

				<i>Specific gravity</i>	<i>Urea G./100 c.cm. urine</i>
(1)					
	10 p.m.—6 a.m. . . . .	..	..	1030	3.6
	7 a.m. . . . .	..	..	1034	3.4
	8 a.m. . . . .	..	..	1024	2.8
	9 a.m. . . . .	..	..	1012	1.2
	10 a.m. . . . .	..	..	1012	0.9
(2)					
	10 p.m.—6 a.m. . . . .	..	..	1014	1.2
	7 a.m. . . . .	..	..	1004	1.0
	8 a.m. . . . .	..	..	1012	1.9
	9 a.m. . . . .	..	..	1016	1.8
	10 a.m. . . . .	..	..	1012	1.7

Although slight albuminuria is not a contraindication to operation, large quantities of albumin, especially if accompanied by casts, exclude surgical measures. When the renal function has been determined as reasonable, the patient should have an intravenous pyelogram to rule out any organic disease of one or both kidneys; only rarely is unilateral renal disease an etiological factor in cases of hypertension.

THE OPERATION

The patient should spend a few days at rest in hospital before operation is carried out, so that the blood pressure may tend to stabilize and the mental outlook be tranquil. One side is operated on at a time, access to both extrapleural and extraperitoneal tissues being obtained by resection of the eleventh rib. The second side is operated on after an interval of

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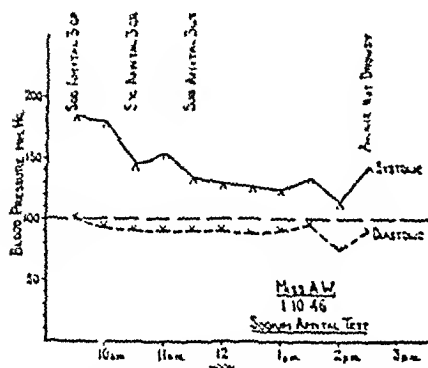


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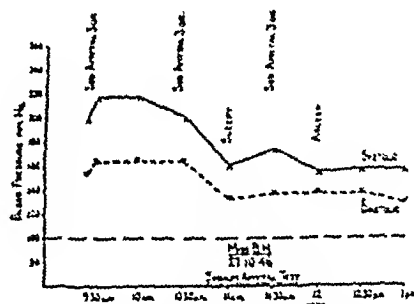


FIG. 3.—Sodium amytal test: type of response in which operation is contraindicated.

ultimately become continuously elevated, and it might be argued that this type is suitable for operation on the ground that denervation will prevent the stabilization of blood pressure at a high level. At present there does not seem to be sufficient justification for including these cases of intermittent hypertension in the category of those suitable for operation.

(b) The cardiac function: Moderate enlargement of the heart should not be regarded as a contraindication to operation, because hypertrophy of the left ventricle is the physiological response to the increase in blood pressure. In cases of longer standing, the presence of congestive heart failure is an absolute contraindication to operative procedures, and it is unwise to accept for operation patients who have a history of anginal attacks. The electrocardiogram may give valuable information on this point, but inversion of the T wave alone is not an absolute contraindication to operation.

(c) The so-called encephalopathies: The occurrence of transient attacks of hemiparesis or hemianopia, with or without aphasia, and disturbances in the fields of vision, do not contraindicate operation provided that careful examination shows that residual symptoms and signs are not present.

(3) *Ophthalmoscopic examination.*—Many investigators grade the severity of hypertension by the appearances on ophthalmological examination. The classification generally used is as follows:—

Grade I: Arteriolar constriction only.

Grade II: Arteriolar constriction and tortuosity with constriction of the veins at the points where they are crossed by arteries.

Grade III: As Grade II, but with hæmorrhages and exudates.

Grade IV: Papillœdema with hæmorrhages and exudates.

Papillœdema indicates the malignant form of hypertension and is an absolute contraindication to operation. In general, the fundal changes reflect

THE MEDICAL TREATMENT OF HYPERTENSION

By TERENCE EAST, D.M., F.R.C.P.

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THE cause of essential hypertension is as yet unknown; medical treatment of this disease can effect no cure, and can only be palliative. But even if the unknown cause or causes cannot be eliminated, for no doubt some are inherent in the individual and can no more be changed than the skin of the Ethiopian or the spots of the leopard, some aggravating factors can be modified. It seems simplest to consider in turn what measures are available.

PSYCHOLOGICAL ADJUSTMENT

Although the high blood pressure is something from which the patient may ultimately die, it is nevertheless something with which he must learn to live. Patients often worry about their blood pressure, and tend to develop a phobia concerning it. To introduce a state of anxiety in this way will certainly make the condition worse. The medical attendant must not stress too much the level of the blood pressure; it is better to avoid giving details to patients and to refrain from quoting figures. A patient is apt to look upon his blood pressure as something more or less fixed, like height and weight, and he should not be allowed to worry about a variation of a few millimetres, one way or another. Assurance and guidance can do a great deal to make life easier for some patients. To allay anxiety is of the greatest importance. After all, many patients live for many years with a high blood pressure, and tolerate it well, particularly women. The actual span of time lived may not in the end be much less than normal.

LIFE AND ACTIVITIES

The temperament of many persons with high blood pressure is not one given to quiet and restful days. They are energetic and overactive, with drive and ambition. They do not relax easily and are inclined to take on too much. It is advisable to go carefully into all pursuits and activities and see which can be omitted or reduced. To advise retirement from work is often bad, and leaves the patient with nothing to do but fret and worry over himself. If the work does not involve strenuous physical exertion hours can often be curtailed with benefit; quiet sedentary occupation is often beneficial. If it is possible to shed some responsibility and its attendant worries this is advisable. Heavy physical work is best changed for something less strenuous.

Rest and relaxation.—The night's rest should be rather longer than the average, say an hour or so. It is a good thing to cultivate the habit of going to bed early; reading in bed should be encouraged to promote this habit. The week-end should be restful. Tiring excursions by car on Sundays do more harm than good, particularly if the patient drives during the week.

ten days. In properly selected cases the operation is well borne, indeed surprisingly so for an operation of such considerable magnitude. After the second stage is completed, the patient remains in bed for about ten days. When he begins to get up, care must be taken to avoid a usual sequel in the form of severe postural hypotension, the systolic blood pressure falling rapidly when the patient stands, so that he may faint. This is avoided by the application of a firm abdominal binder before the patient gets up for the first time, and the binder must be worn, in cases which show this phenomenon, for a period of something like three months. An extensive sympathectomy and splanchnicectomy is not attended by any other undesirable sequel in the female, but in the male, as a result of the bilateral removal of the upper lumbar sympathetic ganglia, the patient becomes sterile although not impotent.

RESULTS

The percentage of patients in whom permanent substantial falls of blood pressure occur post-operatively is probably not more than 25; this fall may be apparent immediately after the second operation or may not reach its maximum for a month or two. In other cases a transient fall is followed by a return to the pre-operative level or even higher, whilst some patients do not show any reduction in either systolic or diastolic levels. There does not seem to be any set of rules by which confidently to predict those patients who will show permanent reduction in blood pressure, although broadly speaking, the earlier the stage of the disease and the better the visceral function, the better the result. On the other hand, a substantial percentage (70-80) of those who are operated upon are given symptomatic relief even in the absence of any fall in blood pressure. The patient no longer suffers from headache or giddiness; after convalescence the physical and mental power is regained, and in many of these cases re-examination will show improvement even in certain physical signs, including a diminution in the size of the heart, an improvement in renal output, and an improvement in the ophthalmoscopic appearances. The net results of operation can often be measured in domestic and economic terms rather than in scientific terms, and when patients are carefully investigated and selected, there is little to lose and often a great deal to gain by operation.

later phases when the pressure is really high very severe headache may be relieved by the intravenous injection of magnesium sulphate, 2 gm. in a 10 per cent. solution (20 c.cm.). Venesection seems to help some patients, although the effect may be chiefly of psychological value. However, if the headache goes, it is worth while. In late cases with intractable headache lumbar puncture occasionally may bring relief, if the pressure is raised. Papillœdema is the indication for this procedure; the fluid must be removed slowly.

DRUGS

These have two fields of action. As so many patients are anxious, nervous, irritable and overactive, *sedatives* are often needed, particularly to render physical rest more beneficial. *The barbiturates* are usually most valuable, particularly if the patient sleeps badly. These may be taken as phenobarbitone, $\frac{1}{2}$ a grain (32 mgm.) thrice daily, and an extra dose at night if a prolonged effect is needed. Sodium amytal, 3 grains (0.2 gm.), is useful. *Chloral*, or chloral and bromide, at night, suits some patients, if the taste is tolerated. If there is suspicion that the basal metabolic rate is somewhat high, as it often is, a course of *methyl thiouracil*, 0.2 gm., twice or thrice daily for a week or ten days, may have a good result. The other field is *the vasodilators*. Since the rise in pressure is due to arteriolar vasoconstriction, this should be overcome by vasodilatation. Actually these drugs are for the most part disappointing. In therapeutic doses the nitrites have very little effect. Sodium nitrite is perhaps the best, $\frac{1}{2}$ to $1\frac{1}{2}$ grains (0.032 to 0.1 gm.), but it may aggravate headache. On the whole these drugs are of small value.

Thiocyanate.—This drug undoubtedly does reduce arterial pressure. The effect is only temporary. The dose should be 6 to 9 grains (0.4 to 0.6 gm.) a day, to begin with. After five or six days the dose can be halved. The level in the blood at which the drug is effective is 10 mgm. per 100 c.cm.; above 15 mgm. per 100 c.cm. there is danger. As little as 3 grains (0.2 gm.) daily may suffice. The potassium salt is used, and the mode of action is unknown. As toxic effects are not uncommon, and the rates of absorption and excretion vary considerably in different persons, the only safe way of controlling the effect is to estimate the level in the blood at intervals of a week or so. Unless this is done the toxic level may be reached. This is therefore most important, for the toxic level is near the therapeutic. Perhaps the strongest indication is severe and intractable headache. The toxic effects are fatigue, headache, mental confusion and giddiness. Rashes and jaundice may occur. The drug will need to be continued indefinitely, with regular estimations of the level in the blood, if any benefit is to accrue. The pressure rises again when the drug is discontinued. Perhaps it is hardly a practical measure. Old age and arteriosclerosis are contraindications.

There is as yet no satisfactory treatment of hypertension with any hormone. Renal extracts still remain in the experimental stage. Palliative measures are all that can be offered: of these the psychological are the most important and need all the patience and thought that a sympathetic and understanding medical attendant can muster.

Some patients in the later phases benefit a great deal by a day a week spent in bed, or at any rate part of a day. Holidays should be as long and as restful as possible. A fifty per cent. increase in rest, and a corresponding reduction in activity, will help considerably to reduce the load.

Diet.—Moderation is the important guide here. There is no virtue in abstaining from red meat or salt; in these days of rationing the restriction is actually enforced, and anyone who lives on the rations can hardly eat to excess. If the patient is actually obese a reduction in weight will benefit his health, but it cannot be expected that there will be any corresponding fall in the blood pressure. As the high pressure overloads the heart, reduction in weight will reduce its work to some extent. Coffee and tea do no harm.

Alcohol.—In moderation this does no harm. It is best taken with food and not beforehand. Thereby undue stimulation of appetite is avoided. Whisky and soda, light wine or beer are probably the best. It may be beneficial as causing mild vasodilatation.

Tobacco.—Here again moderation should be strict. If the patient has a tendency to vasospasm it is probably best to give up smoking altogether. In some persons nicotine definitely causes the blood pressure to rise. But every case must be judged on its merits. Moderation in some is excess in others. Some people are more nervy without tobacco and the deprivation may make them worse; some find complete abstention easier than reduction. Frankly, there can be no promise that the sacrifice will necessarily be beneficial.

Exercise.—Moderate exercise is good, but it should stop short of causing fatigue. One round of golf may be good but two rounds excessive. Very active games are best given up. Walking is the exercise of choice, avoiding breathlessness in the later phases.

Bathing.—Warm baths are good. Exposure to cold water and swimming should be forbidden.

SPECIAL SYMPTOMS

For the most part there are no symptoms due to hypertension: as often as not these are due to other causes; but sometimes there are associated symptoms which appear to be connected with it. A patient who complains of fatigue, mental and physical, lack of concentration and loss of memory, irritability and so forth, is not suffering from these things because he has high blood pressure, but because of his life and habits and temperament. The hypertension is part of his make-up and his reaction to life. It is important to stress this side of the question, so that the patient's attention is not diverted towards the wrong cause.

Headache.—Although many patients never suffer from headache, there are cases in which it is very troublesome. The headache may be associated with exacerbations of high pressure: the head throbs and there is also dizziness. During this phase there is often a tendency to vasospasm. All grades of these exacerbations occur, from the hypertensive encephalopathy with convulsions, to a severe persistent ache, often on the vertex; but it may be anywhere. The unilateral distribution of migraine is exceptional. Often the minor analgesics, and rest with the head not too low, will suffice. In the

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The *changes in the blood pressure* which correspond to the early, middle and later stages of hypertension are, generally speaking, as follows, but it must be understood that these changes merge gradually one into the other and that the length of each phase varies much with different patients. Early in the condition the increase shows itself chiefly as an abnormally high blood pressure response to emotion, fatigue, and cold; in addition, the systolic reading is generally found to be high when the blood pressure is taken. There is an increase in the diastolic figure also, but this in the early stages is not so marked. During the second stage, which comprises that period of hypertension which is of the greatest importance from its effect upon health, the systolic figure remains high and the diastolic reading increases to its maximum. The effect of this is that the pulse pressure may not be greatly increased. The third stage occurs in patients who survive the second owing to the fact that hypertension in them is more chronic and less severe, and because coronary and cerebral complications have not developed. This last group, which may also be called the senile group, have often had moderate hypertension for many years, and in them, probably owing to increasing atheroma of the aorta, the diastolic figure falls, or fails to reach a high level, the result being a rather high pulse pressure.

TESTS FOR BLOOD PRESSURE LABILITY

The sodium amytal test.—This test is discussed in detail by Professor Learmonth on page 463.

The blood pressure increase due to *exposure to cold* also gives some indication in the opposite direction of the lability of the blood pressure. Readings are taken at minute intervals. Immediately after such a reading the hand and forearm are immersed in ice-cold water for one minute. The pressure in the other arm is taken after half a minute and again at the end of the period of immersion. It is then recorded at half-minute intervals, during its return to the previous resting figure.

Tetraethylammonium bromide, given intravenously in 5 c.cm. of water, in a dose of 0.5 gm., is also useful as a means of assessing the extent of possible lowering of the blood pressure in any given patient. The figure is usually comparable with that produced by sodium amytal by mouth.

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THE CRITERIA OF HYPERTENSION

By GEOFFREY BOURNE, M.D., F.R.C.P.

Physician, and Physician in charge of Cardiological Department, St. Bartholomew's Hospital.

THE diagnosis of hypertension is a matter of increasing importance in view of the development of new methods of treatment. These new methods are at the moment chiefly surgical, but the impetus given by them to therapeutic study of the subject may well open fresh possibilities for drug treatment also.

SIGNS OF HYPERTENSION

By hypertension is generally meant a chronic and progressive condition in which there is a slowly continuous increase in the blood pressure, first systolic, and later diastolic also, such increase progressing to a high level at which it usually remains for the rest of the patient's life. Hypertension usually shows itself in the fourth and fifth decades. It is during this period of life that it is statistically most dangerous. When it occurs first in the late fifties, sixties or seventies, its course is generally slower. When it occurs in the thirties or forties, it is usually a more rapidly developing disease and is frequently severe.

The development of hypertension can usefully be divided into three stages, which of course lapse gradually into one another; they can be called the first or early stage, the second or middle stage, the third or last stage. In the first stage, *arterial spasm* seems to be the immediate cause of the hypertension, for this can, for the time being, be removed completely or partially by rest, starvation or sedatives. In the second stage, spasm is even greater and more persistent during the earlier years, but as time goes on more permanent organic changes begin to occur in the arteries and arterioles.

The effects on the blood pressure of sedation, cold, and sympathetic inhibition give some indication of the amount of spasm present in a given case. Cold will raise the blood pressure, sedation and tetraethylammonium bromide will lower it. The influences of measured amounts of these three agents have been standardized into tests, which give some indication as to the amount of spasm present, and which therefore are helpful to a certain degree in assessing the suitability of hypertensive cases for sympathectomy. According to the relative extent of the spasm and of the permanent change, the effect of rest and sedatives varies in its efficiency. The first two stages between them extend over perhaps two-thirds or more of the total duration of a case of hypertension. The third stage is reached when the permanent effects of the arteriosclerosis have become extensive, so that lowering of the blood pressure by external means becomes a matter of increasing difficulty. Also during this last stage much atheroma of the aorta and of other vessels frequently coexists and increases.

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increasing burden and the electrocardiogram not only shows increasing left axis deviation but shows the changes known as left ventricular stress. There is inversion of the T wave in Leads 1 and 4 and sometimes in Lead 2. The shape of the inverted T wave is different from that produced by a previous anterior coronary infarct. In left ventricular stress the T wave sweeps downwards continuously from the end of the descending limb of the R wave, whereas in chronic infarction the T wave frequently turns slightly upwards before it dips. As the disease becomes more chronic, the enlargement due to hypertrophy becomes more pronounced. When coronary atheroma begins to add its effects, the nutrition of the ventricular muscle suffers and dilatation appears. This interference with nutrition may either be abrupt from a coronary infarct, or it may be more gradual and due to narrowing of many of the smaller coronary branches. The history will give the clue as to which of these has been the cause of myocardial failure in a hypertensive case, and further information is available from the electrocardiogram.

The aorta.—The increasing blood pressure produces enlargement of the aorta. The vessel is both elongated and somewhat widened, since it is held firm at the one end by the heart and at the other by its passage through the diaphragm, the elongation causing it to become increasingly tortuous or "unfolded". X-ray examination during the first stage may reveal slight prominence of the aortic knuckle. During the development of hypertension, the aorta becomes more prominent both in its ascending part and at the position of the aortic knuckle and also its descending limb. In the early stages these aortic changes are chiefly due to stretching of the vessel during life, for they may not be obvious in such a patient after death. The permanent elongation and tortuosity are due to atheroma.

The retina.—The state of the retina varies considerably in hypertension. In many cases the retinal vessels and eye grounds remain normal in appearance for a considerable time. The first abnormality is a narrowing and undue shininess of the arteries. The second pathological type is that in which the arteries are narrower and more shiny, and begin to be tortuous. In addition, some hæmorrhages and patches of white exudate appear. The most advanced stage is that in which, in addition to the abnormalities found in the preceding stage, papillœdema is seen. These retinal changes vary greatly in the rapidity of their onset; moreover, they may become well developed in some patients at a comparatively early stage, whereas in others the cardiovascular abnormalities in other parts of the body may be well advanced, the retina remaining clinically normal except for some shininess and tortuosity of the arteries.

The term *malignant hypertension* is one which has a useful descriptive purpose, but which has an uncertain clinical significance. By malignant hypertension is usually meant a rapidly increasing hypertension, generally in young individuals, associated with advanced retinal changes including

papilloedema, and with decreased renal function. This rapid onset of hypertension may either be from an apparently normal state of health, or may supervene on an already existing and rather chronic case of benign hypertension.

The cardiac, retinal, and renal complications of hypertension may occur at almost any stage of the disease. The retinal changes usually occur either at the end of chronic and severe hypertension, or in individuals in whom the condition has appeared suddenly and in whom it is running a severe and rapid course. Renal failure, although common to a slight degree in many cases, is rarely sufficient to produce the clinical picture of uræmia.

Recognition of hypertension at as early a stage as possible is especially important, because it is then that therapeutic measures are likely to have the greatest effect.

The diagnosis of essential hypertension entails two main problems: first, the decision whether this condition is or is not present, and secondly, from what stage of the disease is the particular patient actually suffering?

OTHER CAUSES OF RAISED BLOOD PRESSURE

Essential hypertension is not the only condition which causes the blood pressure to become raised. Other causes of hypertension are as follows:—

(1) Nervous young adults frequently register a raised blood pressure if they are examined in circumstances which accentuate their reaction of excitement or nervousness. (2) During the acute stage, patients with nephritis frequently have a raised blood pressure, which subsides to normal when this acute stage is passed. (3) Patients with chronic nephritis, after the passage of some years, frequently show an increasing level of blood pressure which reaches that found in essential hypertension. (4) Hypertension has occasionally been discovered in individuals suffering from severe disease or destruction of one kidney alone, the other organ remaining normal. Removal of the diseased kidney has occasionally been followed by subsidence of the hypertension in a small number of published cases. It is therefore essential in all patients that excretion pyelography should be performed in order that this condition may not be missed. (5) Finally, the rare abnormality, coarctation of the aorta, must be mentioned. Here a congenital stenosis of the aorta at the level of the ductus arteriosus produces a raised blood pressure in the arms and a reading lower than normal in the legs.

Nervous young adults.—The condition of nervous hypertension is one which is familiar to those who examine any large number of young applicants for posts for which a medical examination is necessary. The general state of nervous tension of the individual is usually manifest. The heart rate is often increased. The cardiac impulse is forceful and excited, and a nervous glycosuria may also be present. The particular points about the blood pressure findings in these normal young adults are that although the systolic figure is frequently raised to the neighbourhood of 170 or 180

increasing burden and the electrocardiogram not only shows increasing left axis deviation but shows the changes known as left ventricular stress. There is inversion of the T wave in Leads 1 and 4 and sometimes in Lead 2. The shape of the inverted T wave is different from that produced by a previous anterior coronary infarct. In left ventricular stress the T wave sweeps downwards continuously from the end of the descending limb of the R wave, whereas in chronic infarction the T wave frequently turns slightly upwards before it dips. As the disease becomes more chronic, the enlargement due to hypertrophy becomes more pronounced. When coronary atheroma begins to add its effects, the nutrition of the ventricular muscle suffers and dilatation appears. This interference with nutrition may either be abrupt from a coronary infarct, or it may be more gradual and due to narrowing of many of the smaller coronary branches. The history will give the clue as to which of these has been the cause of myocardial failure in a hypertensive case, and further information is available from the electrocardiogram.

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The term *malignant hypertension* is one which has a useful descriptive purpose, but which has an uncertain clinical significance. By malignant hypertension is usually meant a rapidly increasing hypertension, generally in young individuals, associated with advanced retinal changes including

both conditions. The presence of a large number of casts suggests nephritis, unless heart failure is present, and the absence of casts is a strong point in favour of essential hypertension. Epithelial casts always suggest nephritis. The specific gravity of the urine is frequently low in hypertension, but it varies considerably, according to the fluid intake and fluid loss of the patient. In chronic nephritis the specific gravity is far less liable to the influence of the fluid intake, and is apt, in severe cases, to remain constant at a figure of 1010 or less.

Renal function tests are also helpful if they point definitely one way or the other. For instance, if the urea clearance test shows a reduction of 50 per cent. of normal or less in each of the two-hourly test periods, the cause of the hypertension is more likely to be nephritis than essential hypertension. Concentration tests are also of value, whether the urea concentration test is used or whether the patient is starved for twenty-four hours, during which time the specific gravity of the urine passed is recorded at three-hourly intervals. The hypertensive patient retains the power of concentrating the urine; the nephritic patient loses it. These are some of the most helpful methods of forming an opinion in cases of difficulty, but each case needs most careful consideration on its own particular merits.

Coarctation of the aorta.—In children, adolescents, and adults up to the age of forty, there is always the possibility that hypertension may be due to coarctation of the aorta. This condition can usually be diagnosed if it is borne in mind at the time of examination. In the younger patients there are usually no symptoms. In older patients there may be headaches or giddiness, or, more characteristically, intermittent claudication or sensitivity to cold over the lower legs, with the upper part of the body remaining warm. Physical examination reveals an absent or greatly diminished pulsation in the abdominal aorta, and in the femoral arteries. The blood pressure reading in the arms will be high, and that in the legs low; for example, the brachial arterial pressure may be 200/100, and the systolic pressure in the legs 100 mm. Hg or less. The skiagram reveals the characteristic notching of the lower borders of the ribs.

mm. Hg, the diastolic figure may remain in the neighbourhood of 80 or 90 and rarely exceeds 100 mm. Hg. Moreover, in such an individual subsequent blood pressure determinations, at the same examination, reveal figures which become lower as the nervousness subsides and confidence returns. It is therefore a wise precaution to examine such patients several times, on different days, in order to establish the functional nature of the condition. The heart is normal in size and shape, as is the aorta. The electrocardiogram is normal and does not show left axis deviation or left ventricular stress. It has been suggested by some observers that it is particularly from this group of young adults that the elderly cases of essential hypertension are more likely to develop.

Chronic renal disease with hypertension.—There is little difficulty in recognizing an acute nephritis in which a raised blood pressure may exist, and it is therefore upon the diagnosis of the chronic form of the disease that attention must particularly be fixed. The history may be helpful. It may reveal an attack of acute nephritis some years previously, of scarlet fever with an abnormally long hospital stay, or possibly of acute tonsillitis of a severe degree followed by a little puffiness of the face, hands or other parts of the body. The age of the patient is another point to be considered. Essential hypertension rarely develops before the age of thirty, so that a high blood pressure in the second or third decades of life is always suggestive of chronic nephritis. When the age of thirty and over is reached the question of age becomes less helpful as a point of differential diagnosis. The appearance of the patient is of considerable help. A high blood pressure in an individual who does not look pale or ill, but on the contrary has a good colour and an alert expression, is likely to be due to hypertension even if a few red blood cells, a few granular casts, and a trace of protein are found in the urine. Another individual, with similar blood pressure figures and renal findings, but who is pale, sallow, inert and ill in appearance, is more likely to be suffering from chronic nephritis. The presence of a definite secondary anæmia, of the iron-deficiency type, with a reduced hæmoglobin and a low colour index, is common in chronic nephritis but is unusual in hypertension. The presence of œdema is another distinctive point. Œdema of the renal type, however slight in degree, is confirmatory of nephritis. Œdema does not occur in hypertension, except as a result of severe myocardial degeneration with failure. If œdema is present in a hypertensive patient, who is not short of breath, it is probably renal in origin and is evidence of nephritis. Œdema which is due to heart failure, is preceded by a fairly long period during which shortness of breath is present.

The condition of the urine is of the greatest importance. Albumin is usually found in considerable quantity in cases of chronic nephritis, but is generally absent, or only present as a trace, in patients with essential hypertension, unless there is advanced cardiac failure, when much albumin is found. Microscopical examination may reveal a few red blood cells in

When it is certain that an individual has a persistent hyperpiesia it is safe to say that if this condition be discovered before the age of forty the outlook is not good, even though the patient be symptomless and show no other abnormality. A second generalization is that at all ages women with raised blood pressures have better prospects than men with similar pressures.

ASSESSMENT OF THE INDIVIDUAL CASE

The further assessment of individual prognosis must depend upon a careful weighing up of the facts discovered from (1) a detailed history, (2) a careful extensive physical examination, and (3) the results of various special tests.

The history should reveal details of the illnesses and longevity of parents, uncles and aunts, it being especially desirable to discover if possible any familial tendency. The status, occupations and circumstances of the various relatives may be most important. The woman who has an easy life financially and no children or other worries is relatively protected from stresses which may prove inimical to other members of her family. The exact nature of the patient's occupation may be of considerable moment, for, however heavy physical labour may be regarded, long hours and great responsibility are important. The labourer, accustomed to physical work, learns to perform his job easily and not to make unnecessary efforts. Many of those who carry the heaviest responsibilities seem quite unconscious of the magnitude of their task. It is when work becomes a burden or an anxiety and the patient is conscious of weariness that all is not well. To a large extent the patient will reveal his reaction to life in general and to his particular work both by what he says and the way in which he tells his story, but it may be necessary to inquire into home conditions and especially as to change in the capacity and temperament of the patient; and it is useful to learn about his habits, interests and hobbies, not only to help in forming an opinion as to the possible causal factors, but to decide what necessary adjustments or changes may be desirable, and also to judge of the difficulties or resistance likely to be encountered when any suggestions for treatment are made.

The cardiovascular system has a remarkable capacity for adaptation and adjustment, given time and opportunity, and will meet all its liabilities in the easiest and most advantageous manner. Treatment is concerned with the questions of how far it is necessary to modify the patient's life; prognosis depends very largely upon how far it is possible to make necessary adjustments. Can the patient retire and be restful?—he obviously has a better outlook if he can. If he cannot retire can he reduce his commitments and his hours of work, or is it possible to devise a hobby or some occupation which will satisfy him? Such considerations affect prognosis in two ways, for the greater the strains and stresses, psychological, mental, financial, physical, the greater the excuse for hyperpiesia. The man with no adequate excuse for a high pressure has a less satisfactory prospect than the patient with

THE PROGNOSIS IN HYPERTENSION

By KENNETH DOUGLAS WILKINSON, O.B.E., M.D., F.R.C.P.

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PROGNOSIS is certainly the most difficult of the three major divisions of practical medicine (diagnosis, prognosis and treatment), said Sir Robert Hutchison; and although careful consideration of statistical records may improve the general knowledge of the outlook for any illness, such studies cannot provide an exact forecast for any individual patient. Suppose that records show that the death rate in pneumonia is 5 per cent., we cannot hope to discover by any mathematical calculation, however complex, whether Mr. Smith who is suffering from this infection will recover or not. In general it is true that the consulting physician who seldom sees any patient repeatedly may be in a less favourable position to give a prognosis about a patient than the family practitioner who has had the opportunity to watch the patient for years, who knows of his family and his habits; but to be really well placed the practitioner should have kept accurate careful notes of the patient, should have an adequate experience of the illness in question and a wide general knowledge of medicine. It is seldom indeed that these necessary conditions exist.

A reasonably accurate forecast of the prospects of any hypertensive patient can only be deduced after a most careful evaluation of a large number of factors. It happens fairly frequently that a routine medical examination reveals an abnormally high blood pressure in an individual who has never had any illness, who has no complaint, and who does not show any other abnormal physical sign. No physician should pass such an event without a careful review. The accuracy of the sphygmomanometer must be checked, coarctation of the aorta must be excluded by noting the pulsation in the femoral arteries, and nervous tension in the patient must be considered. Some nervous persons seem to maintain muscles in such a state of tension that the armlet does not function normally. It is worth while noting that a proportion of those young people, who display evidence of vasomotor instability or hyperexcitability, in later years become established hypertensives, and that whereas either tachycardia or hyperpiesia may be due to vasomotor upsets, the high pressure is more important as a warning of a tendency to a disease in the future. In any patient in whom a high blood pressure reading is obtained the examination should be repeated at a subsequent date, to allow the patient an opportunity to become accustomed to the circumstances, the doctor and the apparatus, and to permit the doctor to decide whether the pressure is persistently raised or was only a temporary incident.

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many difficulties, whereas, in the second place, if it be easy to adjust, modify, control or even remove adverse circumstances, the outlook must be correspondingly improved.

PROGNOSTIC SYMPTOMS

There are some symptoms, common in patients with raised pressure, which are of no prognostic import. Headache is one of these, for neither its frequency nor duration, its intensity nor its situation seem to give any help in gauging the patient's prospects. Giddiness is a second such symptom. On the other hand dyspnœa may be of very considerable significance.

Dyspnœa.—When breathlessness is merely the result of physical unfitness it is of no special importance, but when it appears as a sudden change, so that a perfectly ordinary effort becomes associated with a most unusual or uncomfortable breathlessness, it is well worth attention, and that type of distress in which the patient suddenly awakens urgently breathless, frightened, unable to lie down or to obtain relief, is most ominous. This event is most frequent at night, but may occur during a postprandial nap in an armchair. In either event it is the first stage of an acute left ventricular failure, and is certain to be associated before long with pulmonary œdema. Such dramatic dyspnœa is not likely to escape attention; lesser degrees of breathlessness can be missed.

When the fundus oculi is examined with an ophthalmoscope the patient, almost invariably, unconsciously holds his breath. In the dyspnœic patient this apnœa is followed by rapid and noisy breathing which is of prognostic importance. During the nap after lunch periodic variations in the respiration may be noted. A phase of quietness or apnœa may be succeeded by noisy breathing and general restlessness without actual waking. This may be Cheyne-Stokes respiration typically waxing and waning, or may be merely an irregularity of respiration. Any such breathing suggests a grave outlook.

The pulse may give most useful information. The general rule is that a high pressure goes with a relatively slow pulse and, emotion excluded, a rapid pulse carries a less satisfactory prognosis. Arterial tortuosity is of no value as a guide to a safe forecast, but irregularity of the pulse may be most significant. Extrasystoles seem to be rather more common in hyperpietics than in normal people, and are of no importance in either, but in the hyperpietic patient it is sometimes possible to note with the palpating finger that for a few beats after the extrasystole the pulse alternates in volume and pressure. This observation requires considerable experience and application, for such pulse variation is by no means easy to detect, but once discovered it has the same grave import as the alternating pulse. With a pulse rate which is about normal and a pulse which is regular in time the beats are felt alternately large and smaller, or if a sphygmomanometer is applied the pressure is found to alternate with each beat. Sometimes the pulse sound can be heard to vary all the way from the systolic pressure to the diastolic

point, and occasionally it is best heard at the lower level. Any of these findings denotes that the patient has less than two years to live.

The diastolic pressure is of greater importance than the systolic pressure, for it is less liable to wide variations with changes in emotional tone and posture, but it is not possible to construct a safe prognosis on pressure levels alone without a definite knowledge of changes in level. It is safe to say that a rising diastolic pressure is of serious import and that the outlook is still graver when the systolic pressure tends to fall.

Although the *retinal changes* characteristic of hyperpiesia have been known for nearly one hundred years it is all too seldom that the retina is carefully examined. The vascular changes associated with raised pressures can actually be seen in the fundus oculi, tend to confirm the diagnosis and may point to vascular damage or rupture, but it is the retinal changes that are most informative. In a man, arteriosclerotic retinitis carries a poor prognosis, whilst papilloedema, hæmorrhages and retinal degeneration suggest that the prospects are very bad indeed. In a woman these changes may improve, disappear or even return to normal after the toxæmia of pregnancy: a complete recovery should be regarded as unusual and extremely fortunate; in a man any degree of improvement is extremely rare, and even the earliest retinal change suggests less than five years of life. So that the prospect for a man, or a young woman with no toxæmia of pregnancy, is gloomy in the extreme when retinal degeneration begins.

Cardiac changes.—The hyperpietic changes in the vascular system are structural changes: arteries tend to elongate and to stretch, as can be well seen in the aorta or an X-ray screen, or in the peripheral arteries where the change can be seen or palpated. The heart, since it has to perform extra work, will hypertrophy, but such increase in power will not require any very obvious enlargement unless some change takes place in the myocardium which makes the heart less well adapted to meet its extra work. It is generally true that the greater the enlargement the less perfect is the adaptation of the heart to the extra stress; therefore it is true to say that other things being equal a large heart has a less satisfactory outlook than a smaller one.

The electrocardiogram may provide evidence of great prognostic importance. Normally, since a raised arterial pressure imposes extra work upon the left ventricle it causes an hypertrophy of this chamber, and it is usual to discover a left preponderance or, to use a more recent terminology, a left axis deviation in the electrocardiogram. This is merely a tall R wave in Lead 1 and a deep S wave in Lead 3. But it happens with considerable frequency that this expected change does not appear, the generally accepted explanation being that disease of the left coronary artery makes the normal cardiac adjustment impossible. Evidence of a coronary defect may be obtained in the history of anginal pains, or may be clearly shown by electrocardiographic abnormalities. As may be expected, such coronary defects in an overworked heart will tend to produce more or less cardiac incapacity

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bleeding is stopped. One of the rarer accidents associated with vascular degeneration is a dissecting aneurysm. This condition is seldom diagnosed during life, is difficult to distinguish from a severe coronary occlusion and is usually of short duration—hours; but very occasionally a patient recovers and staggers on for a few months. It is possible to forecast the major risk of a patient with some degree of assurance. The man who shows a marked degree of left ventricular preponderance, a moderate cardiac enlargement, evidence of peripheral arterial damage and of vascular accidents, is likely to have a cerebral hæmorrhage; this possibility becomes a probability if he has a high pulse pressure. It is dangerous to suggest any rule for the relationship of systolic and diastolic pressures, but a useful formula suggests that

$$S = 2D - 20$$

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where S is the systolic pressure and D the diastolic pressure. Now if in any patient the observed systolic pressure (say 200 mm. Hg) exceeds the calculated systolic pressure (when the diastolic pressure is 100 mm. Hg the systolic pressure should be 180 mm. Hg) the risk of a vascular accident is great, whereas when the observed systolic pressure (say 200 mm. Hg) is less than the calculated systolic pressure (with a diastolic pressure of 140 mm. Hg the systolic pressure should be 260 mm. Hg) the major risk is of heart or renal failure or a cerebral thrombosis, because the pulse pressure is low for the diastolic pressure and the circulation rate must be subnormal. It is in patients with advanced arterial defects and subnormal pulse pressure that repeated small cerebral thromboses occur and lead to those mental changes which make the patient such a trial to himself and his attendants, and which cause the deterioration in judgment and capacity for business.

In conclusion, whilst it is preferable to avoid an attempt to reach a minute accuracy in prognosis, it is important to allow knowledge of possible events to assist and guide relatives and friends; so that even though our watchword be "Watch and Pray" we must remember that to be prepared is to be forearmed against emergencies.

with pain, dyspnœa or actual cardiac œdema, and even before the actual appearance of such symptoms it is safe to forecast that heart failure is the probable outcome. The outlook for life is certainly much shorter in hyperpiesia with a right preponderance, and almost three-quarters of such patients succumb within one year of the diagnosis. It is now well known that coronary disease or even an actual occlusion is not necessarily signalized by pain and may appear so gradually as not to attract much attention. This being so, any abnormality in the electrocardiogram which points to a coronary defect, especially when associated with a rapid pulse rate, increases the gravity of the prognosis in a patient with a raised pressure. There is a peculiar exception to this statement, for a number of young people with hyperpiesia develop a bundle branch block and yet live symptom-free for long periods. When such a patient develops symptoms the outlook is grave.

Renal function.—In the general physical examination of the patient a routine investigation of the urine is essential, and it should be regarded as absolutely obligatory to examine a "spun" deposit for casts and pus cells. The results of such investigation may indicate a renal defect which should be included in the data which give a general picture of the condition present; it does not offer any special help in prognosis. Tests of renal function are likewise disappointing in failing to supply a basis for a prognosis. Patients with poor function seem to live symptom-free for many years, whereas others with normal blood urea and good functional tests succumb to some unforeseen accident.

THE GENERAL OUTLOOK

It is worth while considering what may occur in hyperpiesia, and at the outset let it be clearly understood that many patients continue to enjoy normal health for many years. This is particularly probable in a woman who is past the menopause and symptom-free, and may be suggested by a family history of many relatives who die of vascular disease in the seventh decade. Secondly, various cardiac symptoms may appear; frank cardiac failure with œdema is sometimes a direct sequel to coronary defects. Acute pulmonary œdema may also follow a coronary attack, and either form of failure carries a poor outlook.

Vascular accidents are very common and may be serious. The subconjunctival hæmorrhage is the straw which shows the direction of the wind. Epistaxis is sometimes severe, prolonged, and so difficult to stop that a transfusion is necessary. Bleeding from the bowel, kidney or stomach is often attributed to purely local causes, the fact being overlooked that an abnormality such as a kidney stone is more likely to cause bleeding in a hyperpiesic. The most serious bleeding is intracranial; the cerebral hæmorrhage in the hyperpiesic is commonly fatal, whereas some of those who have subarachnoid hæmorrhages recover, and a few even survive repeated attacks, although it is difficult to understand the mechanism by which the

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THE THERAPEUTIC CONTROL OF ALLERGY

All rational therapeutic methods are based on the attempted interruption of some phase of the allergic reaction. Specific avoidance aims at preventing contact between the causal antigen and the allergic shock tissues.

Desensitization, specific and non-specific, attempts to render the cells of the shock tissue insensitive to the action of the antigen; or, allowing the antigen-antibody union to take place, attempts can be made to modify the action of the liberated histamine. There are a number of possibilities here. One is the administration of drugs which have a pharmacological action the reverse of that of histamine, such as adrenaline and other sympathomimetic agents; or, attempts could be made to neutralize or inactivate the liberated histamine. Such a method was the histaminase treatment. This histaminolytic enzyme—discovered by Best in 1929—was found to be quite effective in the inactivation of histamine *in vitro*, and raised considerable hopes regarding its possible clinical application. However, apart from favourable reports by a few of the early, and presumably over-enthusiastic, experimenters, it failed to achieve a therapeutic success, and the treatment has fallen into disuse. Another line of approach to the problem consisted of trying to “immunize” or “desensitize” the body tissues against the action of histamine. This was attempted by parenteral and oral administration of graded doses of histamine itself. But here again the clinical results proved disappointing. A more recent development was the introduction of histamine-azo protein compounds, in the hope that the coupling of histamine with a protein molecule would enhance the antigenicity of the histamine haptene. Preliminary immunological and animal tests were encouraging, but the results of clinical trials have not fulfilled expectations.

THE NEW ANTI-HISTAMINE DRUGS

To-day the chief interest centres on the discovery of a group of substances which combat the action of histamine, and which appear to act by competing with histamine for sites on effector cells, thus blocking the action of histamine on the latter, analogous to the displacement of *p*-aminobenzoic acid by the sulphonamides.

The starting point of their development was the demonstration by Fournau and Bovet in 1933 that certain phenolic alkylamine ethers possessed the property of inhibiting the action of histamine. This led to a systematic examination of the Fournau series of synthetic chemicals by workers at the Pasteur Institute (Staub and Bovet, 1937; Staub, 1939), and stimulated research on related substances by other workers, chiefly in France and America. Many of the earlier substances examined had to be discarded because of toxic effects, but there has been evolved a series of compounds of relatively high efficiency and low toxicity. They are nearly all chemically related, and are either synthetic ethylenediamine derivatives or

THE NEW ANTI-HISTAMINE DRUGS IN RELATION TO THE HISTAMINE THEORY OF ALLERGY

By DAVID HARLEY, M.D., B.Sc., F.R.I.C.

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THE story starts with the classic report of Dale and Laidlaw in 1911 on the physiological action of histamine, which indicated the close similarity between the manifestations of anaphylactic shock and the action of histamine. Hitherto, it had been evident that although anaphylaxis in animals and allergy in man were immunologically strictly specific reactions, the manifestations produced by one antigen showed no basic difference from those produced by other antigens, so it had seemed likely that the reactions were mediated by a common mechanism. Histamine was shown to produce contraction of the smooth muscle of the bronchioles, intestines, and blood vessels; dilatation and increased permeability of capillaries; to stimulate secretory action of the nasal, lachrymal, and gastric glands; and to produce pain and pruritus by its action on the nerve endings in the skin: clearly the same basic changes as those responsible for anaphylaxis, for asthma in the lungs, urticaria in the skin, and hay fever in the nose.

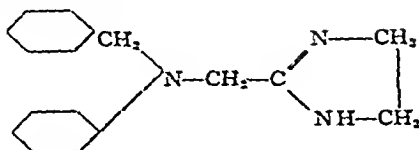
Then Lewis (1924, 1927), in his studies of the blood vessels of the human skin, showed that the reaction of the skin of the allergic individual to the specific antigen was similar to, if not identical with, the reaction of the skin to histamine. Lewis's researches indicated that a substance (H-substance), which is either histamine or a histamine-like substance, is liberated from the sensitized cells by the action of the allergic antigen, and it is this H-substance which produces the actual changes in the blood vessels, and so forth, which constitute the allergic reaction. He also showed that the reaction of the skin to a number of other forms of injurious stimuli—mechanical, thermal, and electrical—was likewise due to the liberation of H-substance.

In 1927, Best, Dale, Dudley, and Thorpe demonstrated the presence of histamine as a normal constituent of the skin and certain other tissues, and Dale (1929) suggested that the allergic reaction was due to the liberation of histamine, present in the skin cells, the union of allergic antigen and antibody on or in the cells acting like other injurious stimuli. The liberation of histamine by the cells is the result of damage to them, and *the allergic reaction is simply the expression of cellular damage produced by the special method of allergic antigen-antibody union.*

The accumulated evidence of more recent work strongly supports the histamine concept, and although there is some indication that not every manifestation of allergy and anaphylaxis can be explained on the basis of histamine activity, it does confirm that histamine is the major factor involved.

TABLE I (contd.)

ANTISTINE (Swiss, Ciba)
(2-[phenyl-benzyl-aminomethyl]-imidazoline)



(Meier and Bucher, 1946; Schindler, 1946; Brack, 1946)

Note: For therapeutic purposes, the hydrochloride or other salt of the above bases is used.

Of these compounds, only benadryl is generally available in this country at present, so the following notes will be limited to the consideration of its properties. It is expected that supplies of antistine—of British manufacture—will be available in the near future. Present currency restrictions prevent the import of antergan, neoantergan, and pyribenzamine.

BENADRYL

Benadryl (β -dimethylaminoethyl-benzhydryl-ether-hydrochloride) was synthesized by Rievschl and Huber in the research laboratories of Parke, Davis and Company. It is a white crystalline powder, soluble in water and alcohol, and is quite stable under ordinary conditions. Benadryl is put up in capsules (50 mgm.) and in elixir form (10 mgm. per 4 c.cm.). (Preparations for parenteral administration are not yet generally available.)

Pharmacological studies in animals demonstrated that benadryl has three main actions:—(1) It alleviates bronchial constriction caused by histamine and anaphylactic shock (Loew, Kaiser, and Moore, 1945; Loew and Kaiser, 1945; Friedlaender, Feinberg, and Feinberg, 1946). (2) It prevents the vaso-depressor effects of histamine (Wells and Morris, 1945; Wells, Morris, Bull and Dragstedt, 1945; Loew, MacMillan, and Kaiser, 1946). (3) It antagonizes spasm of smooth muscle (Loew, Kaiser, and Moore, 1945, 1946; Ellis, 1945). Numerous experiments in animals have shown that there is a wide margin of safety between effective and toxic dosage.

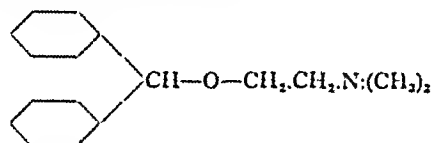
Therapeutic dosage.—The average adult dose is 50 mgm. three or four times daily, preferably administered after meals and at bedtime. In severe cases, acute or chronic, this dosage may be inadequate to achieve satisfactory symptomatic control. In these cases, as much as 300 to 400 mgm. per day, in doses of 50 or 100 mgm., may be required during the initial period of treatment. In acute cases the patient should be instructed to await the effect of the initial dose for at least two or three hours before a further dose is considered. In this type of case the treatment may be started with the average dosage of 50 mgm., three to four times daily, and the total daily dose is increased by 50 mgm. each day until satisfactory results are achieved. A dosage of 400 mgm. per day must be regarded as the maximum.

benzhydryl alkamine ethers, although one of the newest is an imidazoline compound (table 1).

TABLE 1
THE NEW ANTI-HISTAMINE DRUGS

BENADRYL (American, Parke Davis)

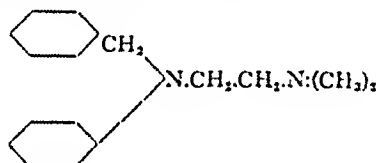
(β -dimethylaminoethyl-benzhydryl-ether)



(Loew, Kaiser, and Moore, 1945; Loew and Kaiser, 1945; Wells, Morris, Bull and Dragstedt, 1945)

ANTERGAN (French, Society of Chemical Manufacturing, Rhône-Poulenc)

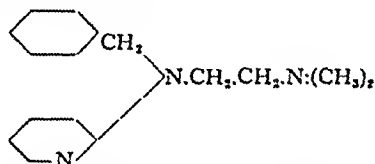
(phenyl-benzyl-dimethylethylenediamine)



(Halspern, 1942a, b; Gaté, Thiers, Cuilleret, and Pellerat, 1942; Parrott, 1942)

PYRIBENZAMINE (American, Ciba)

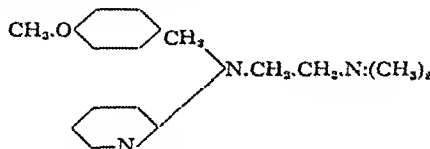
(pyridyl-benzyl-dimethylethylenediamine)



(Mayer, Huttner, and Scholz, 1945; Rennick, Chess, Hays, Mathieson, Mayer, and Yonkman, 1945; Mayer, 1946)

NEOANTERGAN (French, Society of Chemical Manufacturing, Rhône-Poulenc)

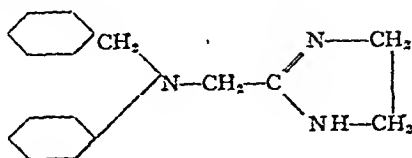
(*p*-methoxybenzyl-pyridyl-dimethylethylenediamine)



(Bovet, Horclois, and Walthert, 1944; Bonvallet and Decourt, 1944; Decourt, 1945)

TABLE I (contd.)

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Therapeutic dosage.—The average adult dose is 50 mgm. three or four times daily, preferably administered after meals and at bedtime. In severe cases, acute or chronic, this dosage may be inadequate to achieve satisfactory symptomatic control. In these cases, as much as 300 to 400 mgm. per day, in doses of 50 or 100 mgm., may be required during the initial period of treatment. In acute cases the patient should be instructed to await the effect of the initial dose for at least two or three hours before a further dose is considered. In this type of case the treatment may be started with the average dosage of 50 mgm., three to four times daily, and the total daily dose is increased by 50 mgm. each day until satisfactory results are achieved. A dosage of 400 mgm. per day must be regarded as the maximum.

When partial or complete relief is obtained, the dosage can usually be cut down and a maintenance dose of 50 to 150 mgm. per day is often sufficient to prevent recurrences. In all cases the optimum daily dosage must be determined by clinical trial. In conditions such as pruritus, which are usually more disturbing at night, the bedtime dose may be increased and the daytime dosage reduced.

Infants and children may be treated with elixir benadryl on the basis of 2 mgm. of the drug per day per pound body weight. The average daily dosage varies from 20 to 100 mgm. The elixir may also be used for adults when maintenance dosage of less than 50 mgm. is required.

Generally speaking, in acute cases the response to the drug is prompt. If no effect is noted within two hours, the dosage may be inadequate. If a trial of increased dosage over a period of twelve to twenty-four hours does not show reasonably satisfactory control of symptoms, the treatment must be considered unsuitable. In milder and more chronic conditions, when a low daily dosage is being administered, a longer trial period may be necessary.

Side-reactions and their management.—The most common side-effects from benadryl are drowsiness, dizziness, nervousness, lassitude, nausea, and dry mouth; occasionally more severe reactions occur. Over 50 per cent. of patients experience these effects in some degree. Such reactions do not always bear a direct relationship to the size of the dose administered, although many patients who experience these side-reactions initially may be well able to continue the treatment on reduced dosage. Gastric discomfort may be reduced to the minimum by taking the drug immediately following a meal or with a glass of milk and a biscuit. Mild sedative effects are not altogether undesirable in many patients, particularly with reference to a night-time dose of the drug, but when such effects become more severe, especially during the daytime, measures for their relief may be desirable. The administration of caffeine, ephedrine, or small doses of benzedrine, is frequently sufficient to prevent or alleviate these reactions. (In view of these sedative effects of benadryl, it must be noted that hypnotics and sedatives—particularly the barbiturates and opium derivatives—should only be administered with *extreme caution* to patients taking benadryl.) In certain cases, the occurrence of marked side-reactions may preclude further administration of the drug.

INDICATIONS FOR BENADRYL THERAPY

Urticaria and angioneurotic oedema.—These were the first allergic conditions reported to be relieved by benadryl. Curtis and Owens (1945) treated 18 patients of whom 11 responded with complete disappearance of the condition except for occasional non-pruritic lesions; 3 patients improved sufficiently to discontinue the treatment. The good results were confirmed by numerous other observers (McElin and Horton, 1945; O'Leary and

Farber, 1945; Shaffer, Carrick, and Zackheim, 1945) in over 80 per cent. of cases. The conditions included acute and chronic urticaria and angio-neurotic œdema, cold urticaria, dermatographia, and urticarial reactions from sulphonamides, penicillin, insulin, liver extract, aspirin, therapeutic sera, and insect bites.

Hay fever and allergic rhinitis.—Benadryl is apparently as effective in hay fever as in urticaria, most observers obtaining symptomatic relief in about 75 to 80 per cent. of cases (McElin and Horton, 1945; Eyermann, 1946; Koelsche, Prickman, and Carryer, 1945). In other types of allergic rhinitis, the response on the average was less satisfactory.

Asthma.—Results have generally been rather disappointing, except in children (Feinberg and Friedlaender, 1945; Levin, 1946). It is interesting to note that a number of observers have indicated that the majority of the asthma cases which failed to respond were of the bacterial-sensitization type (Zolov, 1946). This is in agreement with my own observations.

Pruritic dermatoses.—Various dermatoses characterized by tissue œdema, erythema, and pruritus, have been reported to respond to benadryl—erythema multiforme, eczema, pruritus vulvæ and ani, rosacea, and others—although the results in allergic contact dermatitis have been less striking (Friedlaender and Feinberg, 1946; O'Leary and Farber, 1946; Pinkus, 1946).

Miscellaneous conditions.—The antispasmodic effect of benadryl is of value in dysmenorrhœa. Successful results have been reported in irradiation sickness (Lofstrom and Nurnberger, 1946). Cases of Ménière's disease associated with urticaria have responded satisfactorily (McElin and Horton, 1945). Some cases of migraine have been relieved, and good results have been obtained in a small series of cases of tension headache and pulsating tinnitus (Todd, 1946; Waldbott, 1946). Benadryl is effective in controlling reactions which occur during the course of specific desensitization treatment, and it forms a valuable adjunct to such treatment, as it allows of a considerably greater rate of antigen dosage increase.

CONCLUSION

Although there is no doubt that the introduction of the new synthetic anti-histamine drugs represents one of the greatest advances in the palliative treatment of the allergic diseases since the discovery of the action of adrena-line, it is necessary that enthusiasm should be tempered with a sober appreciation of their limitations, and the fact that they are new palliatives and not new cures should be borne in mind.

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THE DIAGNOSIS OF DYSPEPSIA

By T. H. OLIVER, M.D., F.R.C.P.

*Professor of Therapeutics, Victoria University, Manchester; Physician,
Royal Infirmary, Manchester.*

THE patient with "indigestion" usually shows few physical signs; the symptoms may be vague, and the primary cause of the disturbance far removed from the stomach itself. In the majority of cases the trouble can be attributed to functional causes or to a neurosis, but in the minority these same vague symptoms may be an indication of serious organic disease and can prove a trap for the unwary.

Owing to the scarcity of physical signs an exact history is all-important, and unless the examiner has before him a clear-cut idea of what he needs to find out and a systematized method of cross-examination, he may soon find himself so overwhelmed by irrelevant detail that both his time and patience are exhausted and an accurate picture of the case becomes impossible. When making such an examination it should be remembered that the cause of the trouble may be in the stomach itself, or in one of the other abdominal viscera, or be due to illness arising in some entirely different system—the heart, the lungs, or the nervous system—or to some general disturbance, such as nephritis or faulty nutrition.

In many years of consulting practice in which I have learned from my own and other people's mistakes, the following scheme is the one I have found to be the most helpful.

HISTORY OF SYMPTOMS

The *mode of onset* may be helpful. Sometimes it has been sudden and the patient has dated it from an attack of "abdominal influenza" many years before; this may have been an attack of unrecognized appendicitis. I recall one case of dyspepsia of many years' duration which cleared up immediately after the removal of an inflamed pelvic appendix which was diagnosed only after a rectal examination had been made. All the symptoms had dated from an attack of abdominal pain many years before. In a nervous person the symptoms may have arisen suddenly after some shock or bereavement.

The *duration of the symptoms* is of first importance. If they are of long standing, cancer is unlikely. A long history with intervals of freedom suggests an ulcer. A short history, especially if combined with progressive loss of weight, suggests cancer and is an indication for further investigation and X-ray examination. Although this is particularly the case in the elderly, it must be remembered that cancer can occur in the young. I have seen cancer of the stomach in a girl of nineteen.

The *type and time of onset of the pain*.—If it is severe and occurs at a

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dyspeptic, and may be a feature of the dyspepsia of pulmonary tuberculosis.

Vomiting is uncommon in duodenal ulcer, but more common in gastric ulcer, and when it occurs the pain is relieved. In the nervous dyspeptic true vomiting is not common, although they may say that they bring up small amounts of watery material, which, however, does not relieve the pain and may even increase it. A history of vomiting at intervals of many hours, and particularly if it is copious and cumulative, is certain evidence of organic disease. I well remember one case in which the stomach had herniated through the diaphragm, causing a kink at the pylorus, which was treated for many months as hysterical because this symptom had not been elicited.

In migraine, too, digestive disturbances and vomiting may be the prominent symptoms, and the headache mild. Headache is not common in dyspepsia, so if it occurs the possibility of migraine should be borne in mind.

Finally, pregnancy may be a cause of gastric disturbance and vomiting. I recall a patient with alleged menopausal dyspepsia, who had been fitted with a Curtis belt which was causing considerable discomfort as term approached—a reminder that it is not safe to diagnose neurosis without an occasional re-examination of the patient.

The vomiting of the gastritis patient, whether due to alcohol or other cause, is usually in the morning, and is accompanied by retching and the expectoration of sticky mucus which may occasionally be blood-stained.

A history of *true hæmatemesis* indicates organic disease, even if no cause for it can be found, and calls for further investigation. It may have been due to a lesion outside the stomach, especially cirrhosis of the liver, which should be suspected if there has been little or no previous pain. Cirrhosis occurs in the just and the unjust, and is often quite unassociated with alcoholism. Hæmatemesis may be a presenting symptom in both cholecystitis and appendicitis: I have seen it in both, but in my experience it is rare, as it is too in early cancer of the stomach.

Needless to say, the frequency and character of the *bowel action* should always be investigated. In hyperchlorhydria constipation is the rule, whereas diarrhœa is common when achlorhydria is present. The alternation of the two signifies an organic obstruction, and is an urgent call for an X-ray examination. A dark-coloured motion, in the absence of treatment with iron or bismuth, is suggestive of melæna.

The possibility that the dyspepsia is due to disease in some other system should next be considered. Indigestion may be a presenting symptom of pulmonary tuberculosis, and its association with cough and possibly with loss of weight should arouse suspicion. I have seen early pulmonary tuberculosis overlooked many times in cases of this type, and so common is it that it is good radiological practice to screen the chest in every case which is to be investigated with a barium meal. Breathlessness on exertion and flatulence only after exertion suggest that the heart is the organ primarily at fault.

definite interval after food it is probably due to ulcer, especially if it is temporarily relieved by food or by alkalis.

The nervous patient may complain of a sensation of weight or heaviness, or sometimes of a "burning" sensation. This last is quite common and I have never found it to be associated with organic disease. The nervous dyspeptic patient also often complains of pain or discomfort immediately after food is taken, or the pain may be continuous and quite unassociated with meals.

Discomfort rather than actual pain is a feature of cholecystitis, chronic gastritis and early cancer of the stomach, although in gall-stones there may occasionally be pain very like that of duodenal ulcer. A history of previous attacks of colic, with or without jaundice, will confirm a diagnosis of gall-stones, and on one occasion a history of intermittent rigors was helpful in differentiating gall-stone dyspepsia from duodenal ulcer.

If discomfort occurs after exercise rather than after meals, and especially if the patient is plethoric and the blood pressure is high, the heart is likely to be the cause of the trouble.

The patient with intestinal dyspepsia complains of vague discomfort in the lower abdomen which is accompanied by intestinal flatulence and is relieved temporarily by the passage of flatus. It is a cause of insomnia and wakens the patient in the small hours of the morning. The common cause is a defective digestion of carbohydrate, in which case the flatus is not offensive. Disturbance of protein digestion is much less common, and in it the stools and flatus are very offensive.

SPECIFIC SYMPTOMS

Flatulence is usually pronounced in cholecystitis, but is common also in cardiac patients and in gastritis. In the nervous dyspeptic, flatulence may be accompanied by noisy eructations; in the ulcer case flatulence may be present but is not usually a prominent symptom.

Waterbrash, although not diagnostic, is always suggestive of duodenal ulcer, and in my view if there is a history of intermittent indigestion, together with this symptom, there is sufficient evidence to warrant a diagnosis even though the X-ray be negative. I can recall a patient I saw many years ago who complained of indigestion and waterbrash, in whom there were no physical signs and the X-ray and gastric analysis were normal, and who perforated a few hours after I had seen him.

Heartburn and acid eructations are common in ulcer cases, but are not so diagnostic as waterbrash. They do, however, suggest hyperchlorhydria, and may indicate the need for alkalis.

Loss of appetite is especially marked in cancer. There is no desire to eat, and meat especially, is abhorrent. The ulcer patient wants to eat, but dare not. The nervous dyspeptic's appetite is fitful and at times he will even confess to enjoying his food.

Nausea is common in the case of chronic gastritis and in the nervous

dyspeptic, and may be a feature of the dyspepsia of pulmonary tuberculosis.

Vomiting is uncommon in duodenal ulcer, but more common in gastric ulcer, and when it occurs the pain is relieved. In the nervous dyspeptic true vomiting is not common, although they may say that they bring up small amounts of watery material, which, however, does not relieve the pain and may even increase it. A history of vomiting at intervals of many hours, and particularly if it is copious and cumulative, is certain evidence of organic disease. I well remember one case in which the stomach had herniated through the diaphragm, causing a kink at the pylorus, which was treated for many months as hysterical because this symptom had not been elicited.

In migraine, too, digestive disturbances and vomiting may be the prominent symptoms, and the headache mild. Headache is not common in dyspepsia, so if it occurs the possibility of migraine should be borne in mind.

Finally, pregnancy may be a cause of gastric disturbance and vomiting. I recall a patient with alleged menopausal dyspepsia, who had been fitted with a Curtis belt which was causing considerable discomfort as term approached—a reminder that it is not safe to diagnose neurosis without an occasional re-examination of the patient.

The vomiting of the gastritis patient, whether due to alcohol or other cause, is usually in the morning, and is accompanied by retching and the expectoration of sticky mucus which may occasionally be blood-stained.

A history of *true hæmatemesis* indicates organic disease, even if no cause for it can be found, and calls for further investigation. It may have been due to a lesion outside the stomach, especially cirrhosis of the liver, which should be suspected if there has been little or no previous pain. Cirrhosis occurs in the just and the unjust, and is often quite unassociated with alcoholism. *Hæmatemesis* may be a presenting symptom in both cholecystitis and appendicitis: I have seen it in both, but in my experience it is rare, as it is too in early cancer of the stomach.

Needless to say, the frequency and character of the *bowel action* should always be investigated. In hyperchlorhydria constipation is the rule, whereas diarrhœa is common when achlorhydria is present. The alternation of the two signifies an organic obstruction, and is an urgent call for an X-ray examination. A dark-coloured motion, in the absence of treatment with iron or bismuth, is suggestive of *melæna*.

The possibility that the dyspepsia is due to disease in some other system should next be considered. Indigestion may be a presenting symptom of pulmonary tuberculosis, and its association with cough and possibly with loss of weight should arouse suspicion. I have seen early pulmonary tuberculosis overlooked many times in cases of this type, and so common is it that it is good radiological practice to screen the chest in every case which is to be investigated with a barium meal. Breathlessness on exertion and flatulence only after exertion suggest that the heart is the organ primarily at fault.

definite interval after food it is probably due to ulcer, especially if it is temporarily relieved by food or by alkalis.

The nervous patient may complain of a sensation of weight or heaviness, or sometimes of a "burning" sensation. This last is quite common and I have never found it to be associated with organic disease. The nervous dyspeptic patient also often complains of pain or discomfort immediately after food is taken, or the pain may be continuous and quite unassociated with meals.

Discomfort rather than actual pain is a feature of cholecystitis, chronic gastritis and early cancer of the stomach, although in gall-stones there may occasionally be pain very like that of duodenal ulcer. A history of previous attacks of colic, with or without jaundice, will confirm a diagnosis of gall-stones, and on one occasion a history of intermittent rigors was helpful in differentiating gall-stone dyspepsia from duodenal ulcer.

If discomfort occurs after exercise rather than after meals, and especially if the patient is plethoric and the blood pressure is high, the heart is likely to be the cause of the trouble.

The patient with intestinal dyspepsia complains of vague discomfort in the lower abdomen which is accompanied by intestinal flatulence and is relieved temporarily by the passage of flatus. It is a cause of insomnia and wakens the patient in the small hours of the morning. The common cause is a defective digestion of carbohydrate, in which case the flatus is not offensive. Disturbance of protein digestion is much less common, and in it the stools and flatus are very offensive.

SPECIFIC SYMPTOMS

Flatulence is usually pronounced in cholecystitis, but is common also in cardiac patients and in gastritis. In the nervous dyspeptic, flatulence may be accompanied by noisy eructations; in the ulcer case flatulence may be present but is not usually a prominent symptom.

Waterbrash, although not diagnostic, is always suggestive of duodenal ulcer, and in my view if there is a history of intermittent indigestion, together with this symptom, there is sufficient evidence to warrant a diagnosis even though the X-ray be negative. I can recall a patient I saw many years ago who complained of indigestion and waterbrash, in whom there were no physical signs and the X-ray and gastric analysis were normal, and who perforated a few hours after I had seen him.

Heartburn and acid eructations are common in ulcer cases, but are not so diagnostic as waterbrash. They do, however, suggest hyperchlorhydria, and may indicate the need for alkalis.

Loss of appetite is especially marked in cancer. There is no desire to eat, and meat especially, is abhorrent. The ulcer patient wants to eat, but dare not. The nervous dyspeptic's appetite is fitful and at times he will even confess to enjoying his food.

Nausea is common in the case of chronic gastritis and in the nervous

seen immediately after turning down the bedclothes, when the cool air impinges on the skin. Sometimes peristalsis can be demonstrated by gentle massage of the abdominal wall. Peristalsis is usually evidence of organic obstruction either of the stomach or intestines, but it may be seen in women with a thin abdominal wall, in the absence of organic disease.

A localized area of tenderness, especially if accompanied by hyperæsthesia, points (according to its situation) to disease in the gall-bladder, stomach, or appendix. The detection of a palpable and tender liver may indicate either cirrhosis or cholecystitis, or gross heart failure. The signs of the last-named are usually so pronounced as to make the diagnosis obvious; nevertheless, on several occasions I have known the diagnosis of gall-stones to be made in cases of cardiac muscle failure. The shoulder-tip pain in gall-stones is so uncommon that it is of little diagnostic value.

In the absence of gross constipation a palpable mass is, of course, diagnostic of organic disease, and usually by the time one can be felt the patient has got beyond the stage of mere dyspepsia, and is himself aware that there is something radically wrong. It is extraordinary, however, how large a growth occasionally can be present whilst producing what are apparently only trivial symptoms.

If the symptoms of *cough* or *dyspnœa* are present, the lungs and heart must be examined with care and, as a matter of routine, the knee jerks. The gastric crisis of tabes is now becoming a rarity, but every now and then I see a case in which the diagnosis has been missed because this elementary precaution has been forgotten. On the other hand, a grossly exaggerated knee jerk may give a clue as to the mentality of the patient and the presence of neurosis.

Finally, an *examination of the urine* may be helpful. Nephritis is an occasional cause of indigestion, although it is not usually an early symptom, and is a sign of uræmia, but I can recall a case in which flatulence and vomiting were the first symptoms of uræmia from the retention of urine due to an enlarged prostate. In diabetics the digestion is as a rule good, and when dyspepsia does occur it is often due to an associated cholecystitis.

An abundance of phosphates is common in the neurotic—on occasions I have found this helpful when the diagnosis was in doubt.

In conclusion, dyspepsia may be due to some uncommon condition which can only be revealed by X-ray examination, such as regional ileitis, or a diaphragmatic hernia, and if the symptoms persist it is advisable to have further investigations done. Nervous dyspepsia, if accompanied by loss of weight, is always a dangerous diagnosis and an X-ray is advisable, quite apart from the great therapeutic benefit of a negative X-ray report. It should be remembered, too, that even the most neurotic patient will eventually develop, and die from, an organic disease, and a diagnosis which in the past was correct may have become obsolete, so an occasional re-examination is advisable. Lastly, an X-ray examination is not infallible and should be repeated if the clinical condition should warrant it.

ENVIRONMENTAL FACTORS

I leave the investigation of the *personal history* to the last, not because it is the least important but because the patient's confidence and the truth are more likely to be gained at the end than at the beginning of the interview. Is there any occupational risk, such as the handling of lead or other toxic material? Are the hours of work unduly long or exacting? Business and domestic worries are a common cause of dyspepsia, particularly if the two are associated. The regularity of meals should be gone into, as well as the kind and quantity of food taken, and the time allotted to them. Is there a reasonable amount of exercise and fresh air, and what quantities of alcohol and tobacco are consumed? Do any particular articles of diet bring on indigestion?, e.g., some people cannot take eggs and the cholecystitis patient cannot digest fried food. Sometimes the patient will confess to cancer phobia which proves to be the real cause of his symptoms, and for this there is only one remedy—the reassurance of a negative X-ray. Occasionally the *family history* can be helpful. Duodenal ulcer and cholecystitis tend to run in families, and in the latter there may be a family history of diabetes.

PHYSICAL EXAMINATION

On physical examination there is often little to be found, but here again the examination should be systematic.

The *general appearance* and build of the patient may give useful information. The patient with gall-bladder dyspepsia is usually stout, middle-aged, and feminine, but gall-stones may occur early in life, in thin subjects and usually in men as well as women. The sufferer from duodenal dyspepsia is usually thin, and the sufferer from nervous dyspepsia almost always so.

If there be anæmia, the indigestion may be due to the achlorhydric gastritis of pernicious anæmia. Indigestion with a microcytic anæmia in an elderly man is probably due to cancer of the stomach. In women, dyspepsia and a microcytic anæmia are most often associated with a simple achlorhydria, but in either sex further investigation should not be delayed. A clean, smooth tongue is usually associated with achlorhydria, and confirmation can sometimes be obtained by finding spoon-shaped nails or by the presence of acne rosacea. The dyspeptic patient with a furred tongue usually has a normal acid curve or a hyperchlorhydria, whether associated with duodenal ulcer or not.

The *condition of the teeth* is often overlooked. Probably dental caries is not as prolific a cause of dyspepsia as was formerly supposed, but serious caries or an edentulous condition may be the cause of the trouble.

When *examining the abdomen* itself, its general shape and the presence or absence of distension should be noted, and it is wise to examine the patient in the erect as well as the recumbent position, as by this the sagging of the viscera towards the pelvis can best be appreciated in cases of visceroptosis. If there be distension, peristalsis should be searched for. Often it is best

seen immediately after turning down the bedclothes, when the cool air impinges on the skin. Sometimes peristalsis can be demonstrated by gentle massage of the abdominal wall. Peristalsis is usually evidence of organic obstruction either of the stomach or intestines, but it may be seen in women with a thin abdominal wall, in the absence of organic disease.

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PRACTICAL POINTS IN THE TREATMENT OF THE CHRONIC SICK

By TREVOR H. HOWELL, M.R.C.P.Ed.

Late Deputy Surgeon, Royal Hospital, Chelsea.

In this country there are thousands of people who have been doomed to imprisonment for life. They have committed no crime, yet there is no one to whom they can appeal against their sentence. Why? Because it was pronounced by a doctor, and not by a judge in his court. These prisoners are known as the chronic sick. Some are imprisoned in their own homes; whilst others may be found in the "chronic" hospitals, whose gates might aptly be emblazoned with the motto: "Abandon hope, all ye who enter here". How often is this confinement necessary? Why do medical men adopt this attitude of therapeutic despair? Many such patients lack treatment, suffer neglect and eventually rot in their beds. Can nothing be done for them?

CLASSIFICATION OF CHRONIC CASES

Patients termed "chronic" may be divided into three main classes. One of these comprises those who need nursing care, but who are unlikely to benefit from medical treatment. Chronic diseases of the nervous system, senile dementia and simple senility are examples of this group. Another is composed of patients gradually going downhill, and includes cases of cancer, advanced tuberculosis, and chronic heart disease. Finally, there is a residue which can benefit by skilful, judicious and persistent therapy. It is the neglect of these patients which is so scandalous. Let us consider what can be done for some of the sufferers in this last group.

ARTHRITIS

A typist, suffering from pain and stiffness in her joints, was sent to a specialist, who informed her that she had rheumatoid arthritis and that her disease was incurable. Soon afterwards she was compelled to give up work, so she left London to be nursed by a friend at the seaside. When she told her new panel doctor about the consultation, he confused the word incurable with untreatable. In consequence, he did not visit her frequently and merely supplied prescriptions for analgesic tablets from time to time. The patient became steadily worse; her limbs contracted; her joints ankylosed. Eventually she developed bed-sores and died in pain from exhaustion.

Yet, in that very town, there was a mobile physiotherapy unit, designed to treat patients in their own homes. If properly employed, this could have done much to prolong the poor woman's life and to ease her sufferings. Physical methods are the bedrock of treatment in chronic arthritis.

Once the acute phase of rheumatoid arthritis is over, its treatment is much the same as that of osteoarthritis. So often patients only reach the

practitioner at the stage when the joints are nearly fixed, the muscles wasted and the limbs contracted. Yet much can be done for those who reach us in this condition. The vital principle is to conserve what movement remains in the joints and to increase it if possible. For this purpose, a combination of heat and joint exercise is necessary. Heat may be applied in the form of wax baths, a radiant heat or infra-red lamp, hot saline baths or diathermy—if this is available. Not less than half an hour, thrice weekly, gives adequate relief of pain and temporary increased mobility. When the joint is warmed, it must be put through its complete range of movements, at least twice, before the period of treatment is considered finished for the day. Once a week, the affected joint should have 2 to 20 c.cm. of procaine lactic acid injected into it or around it. This procedure, advocated by Waugh (1938) and others, allows manipulation while the joint is relatively insensitive. It also appears to diminish the amount of pain suffered, to permit of increased mobility, and eventually to lessen the amount of crepitus present. The use of this solution is one of the real advances in the treatment of chronic arthritis. It must never be injected when a joint is heated, or great pain will ensue, as normal reactions to heat are partly abolished.

Besides these local measures, the general condition of the patient requires some consideration. Apart from the provision of analgesics when necessary, such as veganin or compound codeine tablets (N.W.F.), there is often need for administration of vitamins C and D, the latter in full doses. When over-weight is present, a reducing diet should be prescribed, to take strain off the damaged joints. If there be anorexia, benefit often follows the injection of 10 or 15 units of insulin twenty minutes before the main meal of the day. Many patients are anæmic and need iron in some form. When physiotherapy is available, advantage should be taken of it. Wasted muscles can be built up by the faradic current; painful limbs can be soothed by various forms of heat, as already suggested. In this connexion, one point must be noted: much of the pain and discomfort afflicting the chronic arthritic is due to fibrositis in the muscles; once this is treated, either by heat and deep massage, or by injection of a local anæsthetic, the patient feels both easier and more comfortable. When gross deformity is present, the advice of an orthopædic surgeon should be sought; for the manipulation of a large joint, the application of suitable splints or plasters and the use of some form of extension can give great benefit to an infirm or crippled patient. Yet there is much that a resolute general practitioner can do unaided. *Nil desperandum* must be his constant watchword.

HEMIPLEGIA

An elderly man had a cerebral thrombosis and became hemiplegic. He was first admitted to a general hospital, but being considered incurable, was later transferred to an institution for the chronic sick. Eighteen months later he was still bedridden and more or less helpless. At this point a determined attempt was made to re-

habilitate the patient. Within six weeks he could stand alone; within three months he became fit for discharge, able to walk out of the hospital.

This result was not mere chance. It followed the adoption of a scheme of exercises which I encountered at the West Middlesex County Hospital, where hemiplegic patients are more often discharged to their homes than to institutions for the chronic sick and incurable. In fact, the ultimate prognosis of cases with cerebral thrombosis in Dr. Marjory Warren's unit at that hospital is probably better than anywhere else in the country (Warren, 1946). The scheme can be used in the home of the patient as well as in hospital. The essential fact is to encourage the use of the affected limbs from the very beginning.

At first, with the patient in bed, he is instructed to lift his paralysed limbs with his sound ones several times a day and to put them through a full range of movement. If necessary, the hemiplegic arm can be supported by a sling from above the bed which counteracts gravity and allows lateral mobility. After about six weeks the patient is placed in an armchair at the foot of his bed. He is told to grasp his paralysed hand with his healthy one and to place it on the rail of the bed. When a grip is obtained, the strong hand holds the rail beside the weak one. If the feet are given purchase by a wooden plank or bar between the legs of the bed, the arms can then pull the body upwards and forwards. Thus the patient will soon learn to gain a standing position, first holding the bed, but eventually without support. Later, walking short steps with help can begin, and eventually walking alone. If necessary, a walking brace and iron can fix a feeble lower limb. Use of the arms is encouraged by grasping the handles of bags, suitcases, or even the domestic iron. A walking stick aids the legs as well as exercising the hands. It is important to make the patient raise his arm above the shoulder at least once daily. In this way he prevents the occurrence of the stiff, painful shoulder syndrome of hemiplegics.

By these methods, many patients will attain partial or complete functional recovery instead of becoming helpless invalids, confined to bed, contracted and paralysed. Such cases should be regarded as veritable tragedies, discreditable to the doctor concerned.

CONCLUSION

The two conditions mentioned give examples of what can be done for chronic patients. Others could be quoted if space permitted. In the past, rehabilitation has been employed for those injured in war. It is high time that the same methods were used when treating those whose diseases have a less dramatic onset. Although the most advanced technique can best be carried out in a hospital, there is much which the general practitioner can attempt and achieve. Since in present circumstances it is so difficult to get patients admitted to hospital, here is the necessity which may become the mother of more than invention.

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- Warren, M. (1946): *The Practitioner*, 157, 384.
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THE TEXTURE OF THOUGHT

By C. G. LEAROYD, M.R.C.S., L.R.C.P.

CLOUDS are divided into cirrus, cumulus, stratus—just like that, and in dealing with any nebulous subject there are obvious advantages in using this incisive and slightly majestic approach. In this article we intend to employ it while, unconcerned with mechanism or process of manufacture, we look at the texture of thought as it comes off the loom of the mind. We define thought as the most conscious product of the mind; this definition will often make thought mere sensation—as when one hits one's finger with a hammer—and this extension of meaning is postulated.

CHILDHOOD

Infant thought must be directly in terms of the senses. A father is a large, strangely smelling, coarse-coated, early morning and evening phenomenon, capable of making clicking noises and causing satisfactory up and down movements long before the infant has learnt one of the first pieces of that shorthand, which for a large part of his life is to be the chief task of his mind, and calls him "Da-da". And ages before that—for the wheels of time are geared exceeding low in young life—a mother is thought of in terms of a pleasant tussle with the muscles of the mouth, as a necessary preliminary to a feeling of repletion, as a near horseshoe of white, warm pullable skin, as a peculiar series of tactile and muscular sensations, as a semicircular canal stimulator capable of changing the boring horizontal to the more amusing vertical position; all this and much more, long, long before she is "Ma-ma".

At no time of life are the senses, the five specialized and the host of unspecialized, woven in such equal proportions into the texture of thought, although like an old civilization without scribes this is forgotten.

Smell thoughts play a large part in infant and child thought, but as they do not lend themselves to words they share the oblivion. Some characteristics are: they label a place—the smell of nasturtium leaves that is a corner of the garden, the leathery smell that is the attic; they are minatory—the myocetal smell of cellars, the smell of the cupboard where the canes are kept, the foreign smell of richer houses and some people, the smell of others' ordure; they are all-embracing, comprehensive: one of mine was of an Earl's Court Exhibition, probably of sandalwood, cigar smoke and London fog, which stood for the British Empire and all the mysteries of the East more vitally than the words do to-day, and many will remember how one sniff at Uncle Timothy's house in the Bayswater Road and all Galsworthy's Victorian England was unfolded; in a negative sense they are possessive—except at first one's own toys or clothes don't smell.

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Smell thoughts are not common in adults except in sexual fantasy, but when they do occur they often recall the whole texture of child thought.

Thinking in terms of taste dominates child thought for longer periods than most adults can remember; it excites exploratory, anticipatory and acquisitive visual thoughts. It has much in common with smell thinking, and, although we said we were not concerned here with mechanism, I cannot refrain from pointing to a beautiful mechanism seen in children and farm workers, in which when the olfactory nerves are numbed by cold or catarrh a thin stream of mucus from each nostril carries their messages down the upper lip into the mouth, as though the Home Office took on the Foreign Office work while the latter was under repair. I have never seen this economical device appreciated in print.

Tactile thoughts are prominent strands in the texture of infant thought, although like an animal language they are almost hidden from us. It is certainly a patterned conception and here are a few examples of those that survive to the age of verbalization: the slight genital comfort in the stark grimness of the bathing-slips; the tight, compact topside and exposed vulnerability at and below the water-line of an Eton suit: the proud, grown-up restriction of long trousers; the "young" feeling of silk stockings; the cold outpost and warm "citadel" pelvic area of short skirts. The last two I get from women in whom tactile thought persists more strongly than in men, although men think more in terms of heat and cold: they stay in the water for a shorter time, and get solace thoughts from toasting their backsides. Still tactile thoughts are only just beneath the nap in the male texture, and although men treat them rather as the Junkers treated their wives, they are there. In the *Lancet* some years ago it was recorded that men going to have a cold bath took much longer to shave than those going to have a hot one, and men are known to stroke their hair, pull their moustaches, scratch various parts of themselves as the solace meat in the sandwich of disturbing thought. I knew a sea captain who always scratched his peri-anal region in moments of stress—fog, collisions and so on. Tactile thoughts come nearer to pure sensation than the four other specialized forms of thought and have a comfort-distress swing. In going to sleep they are the last of the five to fade.

A word must be said about all the hundreds of sensations coming from the rest of the body which are woven into the texture of thought, tingeing it and capable of being verbalized only in moments of stress. They remind one of that political back-bencher, Isaac Newton, M.P. for Cambridge, who spoke only once—to have the window shut—i.e., they are articulate only when uncomfortable. Such are the "preparatory" thoughts of stretching muscles, the "active" thoughts of too long quiescent joints, the "hoarding" thoughts of a full rectum, the "anxious" thoughts of a full bladder, the "wondering" thoughts of an emptying one—the infant's last failures in continence come from pure wonder—the "easy" thoughts from rhythmical movements, e.g., the peripatetics: all these and a hundred more play a prominent part in the texture of child thought. Sometimes we get a re-

minder of this. "It makes me feel like being a boy again", I once heard a medical student say who had just had his teeth scraped.

Visual thoughts.—Somewhere between the ages of three and four—one has to be annoyingly didactic in a short sketch, but the age is generally the same as that of the adult's memory of earliest childhood—the most prominent fibre in the texture of thought has become the visual, and with the majority of people it will remain so throughout life. It is a relief for the essayist to get to it, for the visual world has an adequate vocabulary. But there are important differences between a child's visual imagery and an adult's. A child's is more highly coloured, more clearly cut, and moves more slowly; it is caricature-like; as with the cinema it often has "close-ups" but from about three inches; its figures are much bigger. There is a Hogarthian or Disneyan quality about the people a child thinks of visually, but then, of course, people are Hogarthian—this is noticeable on coming to town after a long spell alone in the bush or after an illness—or rather Hogarth and Disney have the trick of depicting people as they are; it is only by seeing too many of these extraordinary animals "men" too often, that they look to us commonplace.

All the qualities of a child's visual thinking are reproduced in an adult's dreams and nightmares, and also, as we shall see, by certain disease toxins and by certain drugs, e.g. alcohol and morphine. Because it is known they are appreciated, children's coloured picture-books are sometimes kept in opium dens. Whether this reversion to earlier textures of thought can be regarded as an abandoning of specialized forms of thinking in times of stress or as the organism utilizing the toxin—to keep the patient quiet or amused, or frightened—would be a cosy subject for debate, but is outside the scope of this article.

We must give space to that form of a child's visual thinking, called *fantasy* or *day-dreaming*, which perhaps amounts to half, the hidden, alter ego, the preparatory half of it. Although it is predominantly visual, touch, taste and smell thoughts are well represented, and as the child grows older more and more auditory thinking is introduced, at first rhythmical or musical, then in heard words, then spoken words, and the first of these are just captions, later soliloquies, and later still dialogue and argument.

The horse-infatuated girl standing in a puddle—she was a horse watering "National Velvet"—and the curious behaviour of Ian Hay's boy in a meadow—he was a liner docking at Aden—are an adult's glimpses at this hidden preparatory world of childhood. Really they are most intricate and adaptable and almost hallucinatory in their vividness. Here is one from the *Lancet*, which shows how tactile thoughts were used:—

A small boy took a puss-moth caterpillar to church in a matchbox; it escaped; he was reproved. Feeling that kindness to animals would appeal to grown-ups his excuse was that he thought it would enjoy the outing. It is difficult to share mental pictures with others; one can only do it with words, which are coarse brushes and paint differently with other people, but by bribery, patience and by casting off

for a little while the crust of years I did get a glimpse of what was going on in that small boy's mind during that Sunday service.

Two preliminary episodes must be recounted. The first is that some days before he had watched men shooting driven partridges; they were dressed in plus-fours, one of them was smoking a cigar, and they were such deadly, nonchalant shots that they made a great impression on him.

The second is that in the school chapel in the previous term a preacher had said that if you look for the nasty things in life you will always find them and find little else, and had illustrated this by pointing out that if you listen for the sibilants of the S's in song or speech you will hear them and them alone. The boy, discarding the moral, had pounced on this interesting discovery. Well, there we are. All an outsider would have seen is a small boy in church, his hot hand claspings a match-box, in which the movements of his pet caterpillar, Buddy, could faintly be discerned. Really, what was happening was that he and Buddy, both in plus-fours and smoking cigars, were shooting sibilant partridges which were coming over in enormous numbers—"The Scripture moveth us in sundry places", for instance, was two brace, and were shouting to each other, "O good shot, Buddy", "O splendid right and left, Archie". I gathered they never missed.

These fantasies are repeated many times a day, month after month, modifying to include new persons, fresh delights and triumphs; they are egocentric; at first the child is the centre of a wonderful world, later of a wondering world, and it is this element of unchecked immodesty that makes him reticent about them. It would never occur to a child to let even a brother into his full kingdom, although he might let him have a peep at the outside of it.

The repetitive element in child fantasy is illustrated by the story of a small boy who spent a whole morning happily climbing from a stool on to a chair, turning round and with crooked arm coming down again. They said he was playing at going up the steps of the club, having a drink with a friend and coming down arm in arm. Cold humiliating words! They don't bring out the glorious feeling of going up steps alone; the taste amounting almost to sensation of vividly coloured bubbling drinks, seen from about two inches, and the freedom to have as many as one likes; the fascinating feeling of long trousers and a top hat; the feeling of perfect friendship and contact with an equal, a person of one's own world, indeed of one's own creation, a composite of the most desirable people one knew or had imagined, someone who could be admired, trusted, followed or bossed as mood demanded—extraordinarily like some adults' conception of God!

As the child grows older more props are required for his or her fantasy—real noises, uniforms, more realistic dolls—and in this reaching out for reality we see the function of child fantasies; they are, of course, the first drafts of the ambitions of men and women. Bit by bit the impossibilities and many of the improbabilities will be pruned from them, and when eventually they have played their part in making the child a bishop or a bank clerk, a Don or a donkey-man, a mother or a schoolma'am, like an empty pupa case they will be forgotten. Only in the sexual sphere does visual fantasy with tactile and smell accompaniments persist in full strength, though occasionally holidays may be taken in it, vicariously in novels or

plays, under emotion as a retreat from fear, as we have seen with certain disease and drug toxins, and possibly as a rejuvenator in old age.

ADOLESCENCE

Before puberty the child reaches a completeness, an all-roundness, that he will never attain again and this is reflected in the texture of his thought. Visual thinking is vivid, fantasy is alert to adapt itself; auditory thinking ranges from the rhythmical to an almost hallucinatory copy of known voices—and where the two meet in couplet or pun, that is exquisite to him. Some people never outgrow this pre-pubertian phase. The symbols we call words are rapidly unsymbolized in his mind, the fibres are easily seen in the strand, e.g. "table" in a flash is reduced to a picture of a particular table, the sound of a fork being laid on it, a close view of its grain which he sees when doing homework, its "Ronuk" smell, i.e. words are not yet ends in themselves. Smell and taste thoughts occur in the texture predominantly three times a day, touch thoughts of prestige and pleasure and pain are there, all parts of the body are represented, alert yet unverballed, unashamed, and dominating the scene and colour are the emotional thoughts and moods from the endocrines; in fact, our twelve or thirteen year old's mind is the most perfect all-round organ, but unadapted, unpruned, unspecialized, rather like one of those lovely caterpillars that turn into rather dowdy moths. If he is a savage the texture of his thought may not alter much at puberty, but if he is civilized or urbanized, which means that his kind is concentrated and his interests multiplied, both a hundred times, then vast changes must take place now protection has gone. Fantasy must be drastically cut down, de-egoed, and then a wishy-washy extract of this is put into stilted words, "what I want to be". *Heard-word thinking* plays a much bigger part in the texture and makes him imitative, and later as he begins to feel his way in social contacts there is an increasing element of *spoken-word thinking*. Muscle, joint, touch and smell thoughts are gradually shunned like disreputable old cronies except in his vital animal moments—micturition, defæcation and emotional situations. Taste thoughts continue prominent until he has finished growing. The essential change in these years is that thought has to be much condensed—the process has been going on slowly ever since the infant made that triumphant précis "Ma-ma", but now it is enormously speeded up—scenes and sounds are potted into words and gradually their sensory content is forgotten; his storage and bartering power are much increased by heard-word and spoken-word thinking chiefly, but seen-word thinking for imperative needs.

It is necessary to emphasize that this intense condensation is made necessary by civilization. I once spent some time with an Australian bushman; to him words were hardly currency, they were a clumsy form of barter; he remained such a vivid visual that one glance at the site where he had camped months ago would tell him what had fared there since, and

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so accurate was his olfactory memory that he would recall the smells of a ride as we would a story. Remember, too, the boyishness of sailors and the slow speech of the countryman.

ADULT LIFE

The texture of thought in adult life is determined by function and the ability to fit the function by inheritance. If we are thinking of an interview ahead we shall probably think in heard words, the picture moving obscurely in the background; if of a lecture we are going to give, then in terms of our spoken word and just hearing it; if we are going to meet a friend we shall think of him visually; if we are groping for sixpence in the dark we may even think in terms of touch; if we are catching a train we may rise to the level of the seen-word thinker and think "Waterloo 6.54".

Probably most young adults use all forms of thinking many times a day, but eventually one or two modes of thinking will become predominant in answer to the demand of function. Barristers, barmaids and barterers will tend to become fixed as heard and spoken word thinkers; sailors, farm-workers and most ordinary people remain predominantly visual, but with less colour, less clarity and much quicker motion than they had in childhood; editors, printers and any whose business is entirely in the written word—students temporarily before exams—think in the written word; scientific men, philosophers, psychologists and many other brain workers think in those further concentrations of words, ideas, concepts, abstract thoughts, which have often been condensed *via* seen-word thinking.

Then, of course, there are many specialists' ways of thinking: Mr. Brown, who is "Dad" at home, a symbol to which all the senses of all his family contribute, is a composite smell to his fox-terrier, a voice to the telephone girl, two unequal columns of figures to his bank-manager—an overdraft!

IDEATIONAL TYPES

By their predominant mode of thought people are classed into "ideational types" and these can be roughly determined by a questionnaire such as is found in books of experimental psychology.

Visual thinking.—Here we may perhaps look at some of the clinical implications of the matter. As we saw, all children are vivid visuals, most adults are mildly visual, but the most expert and specialized minds have little visual thinking. In some illnesses there is a reversion to child imagery. The reason why there are so many tuberculous writers is that they are people who, having acquired a proficiency or expertness in words, are every now and then sent back to the nursery of child thought, hence "Treasure Island". The repetitive element in child fantasy, modifying it from time to time to conform with fact and function, is seen in these bouts of tuberculosis, e.g. Elroy Flecker repeatedly recasting "Hassan" from his

consumptive bed. When we remember the metrical jigs and tunes in which children think before words have become easy currency, and that tubercle takes its host back to this stage too, surely we come near to the sacrilege of examining the poet with the clinical lorgnette and seeing Keats bringing back the splendour, yes, and the wonder of a child's dream.

Other fevers may also have this action, and Allbutt's observation that the delirium of typhus selects the brain-worker may have relevance here. My one personal experience of malaria gave me unhappy, hopeless imagery, with momentary close-ups of demon faces, rather suggestive of a child's quick amplitude of imagery, when a crack in the paint of the cot can be turned into a fairy lane. Influenza can certainly send patients back to childhood's vivid imagery.

In an epidemic on a troopship in 1940, I had a young R.A.F. officer who lay like a log for five days. He repeatedly refused the offer of books and said he was quite happy. Having pursued this minor hobby of finding out thought forms for a long while, and having acquired some of the characteristics of a corkscrew, I said to him "I should dearly like to know what has been going on in that great brain of yours, what you have been imagining, but I don't suppose you'd care to tell me". Then I got it:—He'd come down in Germany, but luckily had a pot of invisible paint on him—incredible adventures—got under Hitler's bed, saw his carotids pulsating; said he looked quite pathetic without his false teeth!

Alcohol may also produce a childish texture of thought; the friendliness, the egotism, the coloured pictures, and that characteristically childish attitude of mind—the acceptance of, or rather ready surrender to, things as they are.

Many drugs have the property of de-specializing the texture of thought—opium we have already mentioned as giving coloured vivid imagery, unhindered by probability or possibility, which is part of its lure and charm.

Verbal thinking.—After the visuals the next most common type of thinker is he who for economy, conciseness and conveyance thinks in phantom soliloquy, dialogue or argument, the spoken-word and heard-word thinkers. Stoddart, in his "Mind and its Disorders", says that he himself had distinctly changed from a "visual to a verbal motor", i.e., he thought as though he were speaking—a common functional change for one with increasing social contacts. The gentleman who conducts a noisy argument with the shrubs in the mental hospital garden, the schizophrenic who hears the voice of God thundering orders at him, the relentless accusations that the paranoiac hears, are examples of this way of thinking in disorder.

The early *seen-word thinker* is a rare bird and gets the gold medals—the scholar, the clever man, the synthesist of others' hoards, academically—our ruler. The headmaster of the public school who remembers the names, initials and birthdays of all boys past and present is of this "ideational type". I knew a Don who could tell one off-hand where any British merchant-ship was—he didn't see the ships, he saw Lloyds' Daily Index. I once heard a University sermon by one of these—brilliant, borrowed

brilliance, trying, oh so frantically, to be original. There seems to be a genetic cause for early facility in this form of thinking; Dean Inge has drawn attention to the familial incidence of ability in classical scholarship, of which he himself is a victim. And here is an abstruse fact that certainly doesn't fit in with our weaving simile: when the gentleman who can learn long lists by heart has been doing it for a number of years, the seen-word (rarely the heard-word) process drops out of consciousness, but he learns his list or passage just the same. A similar process can be seen with ordinary visuals who read a book and get the picture and are almost or quite unconscious of the words. The young seen-word thinker by this process invariably goes on to be a complete concept and abstract thinker. But quite ordinary folk whose lot is cast almost entirely in the world of the written word—printers, librarians—will eventually get the fixed habit of thinking in seen-words; in the same way as a person temporarily, after a long day's driving or fly-fishing, thinks in terms of an unending road or a speck of colour on flickering waters.

The concept and abstract thinker.—And now with humble feet we come to those who alone in ordinary parlance would be dignified with the name of "thinkers"; the concept and abstract thinkers, whose texture of thought has indeed changed from that of the babe who made his first bright, sensory summary in the word "Ma-ma". But the process is the same—condensation; condensation which passeth understanding and is devoid of sensory and verbal labels. Yet if in one of these great minds the abstract thought of, say "the Infinite", were to be teased out, all its fibres would be found to be sensory, one of which might well be the sensations stored in memory of restless nights. Freud says that adults forget their childhood; but how could they function in a modern world with the long-hand of a child's thinking. How could a doctor who hears the telephone ring, guesses the probable caller, remembers previous confinements, weighs the merits of two district nurses, recalls a warning in Eden—the book, not the garden—rearranges his programme provisionally, thinks of the failings of his car and the contents of the midder bag and then says "Hallo"—now could such a one remember, let alone practise, which is the only real way of remembering, the long, long thoughts of youth? Still I doubt whether Freud would have been so emphatic if he had worked with rural folk living in semi-isolation.

Great as are the powers of these concept and abstract thinkers, perhaps we may be permitted to glance at them from a clinical angle. They are prone to what Clifford Allbutt called "this inveterate disease of mistaking words for things". They completely lack an introspective memory and are rather arrogant about it. Francis Galton, one of the pioneers in this field, found Royal Academicians who scoffed at the idea that anyone could think in pictures. Rossett in his "Mechanism of Thought" says: "The thought of the appearance of a person or a landscape is devoid of definite outlines or colours"—a statement which would make all children laugh and earns the

scorn of us visuals who daily see faces, long since dead, to their last loved wrinkle.

A senior classics master, whom I asked about his mental processes and to whom, having found that the colostrum of my milking is misleading, I gave my usual warning, "Don't tell me now, tell me in two or three months", wrote and asked to be excused from his promise as the effort of introspection was upsetting him. A lecturer in psychology whom I asked several times hummed and hawed; obviously his mental processes were so specialized and rigid that he couldn't twist round and catch the tail of his thought. It is probably the same as with other biological specializations—after a time there is no return. These advanced thinkers excel in the humanities, but they are poor at the utilities—it takes quite a lot of visual thinking to cook a meal. Their supreme merit is that theirs is in some degree the massed knowledge of man in words; they are safe men, like signallers shackled by a code, and cannot be lured away by exciting pictures. One must accept the axiom: they who think in one texture find it hard or impossible to realize that there are other textures.

THE EFFECTS OF THOUGHT ON WRITING

The writing of the various ideational types is characteristic: the schoolboyish, telegraphic, unadorned style of the visual, e.g. John Hunter; the easy flow of the heard- and spoken-word thinker—all popular novelists and men like Osler and McDougall. Asquith wrote of "World Crisis": "Winston's book seems to be a curious compound of fine writing and boisterous clap-trap"—the fine writing is without doubt from spoken-word thinking. The output of the abstract thinker is almost unreadable by the visual; it has to be translated into pictures bit by bit. Most philosophy and theology, not a little psychology, is of this kind. For the purposes of this article I tried to read Kretchmer and Monsarrat, but being a visual with a growing adulteration of heard-word thinking, I found them tough fodder.

The whole question is full of paradox: they who have visions are inarticulate; they with the powerful minds can't dream dreams.

A SUMMING-UP

Ever-condensing symbols as words are, I have nearly spent my five thousand of 'em and the rest I use in thanking Professor Wood Jones, who twenty years ago in Honolulu set this hound on the fundamental and fascinating trail with his crisp "How do you think? in words? in pictures? or—?" and in apologizing to the host whom the hound has worried—friends and strangers, Dons and trawlermen, my brother officers at sea, especially two second mates who would become expansive in the middle watch; midwives waiting for the dawn of day or life; boys in camp, especially out in the sailing dinghy; patients, publicans, and—by introspection—my own sinner. "When you said that, how did you think it? Did you see it? Did you hear it? Your own voice? Or . . . ?

PAIN AND ITS PROBLEMS

VI.—PAIN IN THE GASTRO-INTESTINAL TRACT

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THE exact etiology of many of the symptoms and signs of disease remains obscure. Visceral pain, or pain associated with disorders of a viscus, is an outstanding example, although many explanations of its cause have been propounded. The problem of its origin is of interest to the physiologist, but the final solution will result from close cooperation and exchange of ideas between the clinician and the laboratory worker. In this article it is proposed to deal with the physiologist's contribution to the problem, in the hope that it may be of value to the clinician in dealing with the many patients who complain of abdominal pain.

ANATOMICAL BACKGROUND

The afferent nerves of the abdominal viscera enter the central nervous system along many paths. Generally speaking, the splanchnic nerves and the vagi carry afferent fibres from the solid and hollow viscera, whereas the parietes are innervated by the cerebrospinal nerves of the body wall, including the phrenic nerves. All the afferent fibres have the same basic anatomy. The cell body of the fibre lies in a dorsal root ganglion, the central process of the nerve entering the spinal cord through the dorsal root. The presence of the afferent fibres in the splanchnic nerve, which contains also sympathetic fibres, is to be considered more as an anatomical convenience than as a separation into a physiologically distinct class of "sympathetic afferents". Passing intact through abdominal ganglia, sympathetic chain, and white rami these fibres enter the spinal cord *via* the dorsal roots. Whereas the splanchnic afferent fibres are concerned with pain sensation, those in the vagi seem to subserve less definite sensations of hunger, satiety and nausea. The latter fibres enter both the medulla *via* the cervical vagus trunk, and also into the spinal cord *via* branches to the 2nd to 8th thoracic spinal roots—at least, in cats (Harper, McSwiney and Suffolk, 1935). The viscera have a relatively poor supply of sensory fibres, when compared with the rest of the body. It has been remarked that the total of these fibres is equivalent to a single dorsal root.

Spinal cord entries.—Information can be obtained in animals by stimulating a viscus and observing a reflex response produced thereby, such as dilatation of the pupil. Dorsal roots are sectioned until the response is abolished. Such experiments show that afferent fibres from any viscus enter

the spinal cord through many dorsal roots. On the other hand, it is stated that the entry of pain fibres in man is more restricted, usually to two or three roots. For example, considering the fundus and body of the stomach the entries given by various workers are as follows:—for pain and tenderness in man, T.6–T.9; for pupil dilator reflex in cats, T.3–T.13; for reflex respiratory changes in dogs, T.4–L.3. Whether or no man has an equally wide entry for fibres not specifically concerned with pain is a question which awaits an answer.

Central pathways.—These still await precise definition. In animal experiments it has been shown that the impulses producing reflex responses of brain-stem nuclei ascend bilaterally in the cord. The crossing of fibres occurs in the segment above their segment of entry, and the fibres are scattered in the lateral column of white matter. In man, bilateral section of the antero-lateral columns of white matter of the cord is said to abolish visceral pain (Leriche, 1937). Ivy (1941) states that the bilateral cordotomy must be deep enough to include the adjacent fasciculus proprius and much of the grey matter itself.

SENSITIVITY OF THE VISCERA

Observations in man.—That William Harvey could touch the human heart without provoking sensation showed that there are differences in the sensitivity of the visceral and of the surface sensory fields. Von Haller (1755) recorded that gross trauma to viscera was painless. Lennander (1902) showed that the intestine could be cut, crushed, burned and stretched without causing sensation. This surgical experience has been repeatedly confirmed, even in the absence of any analgesia. The intestinal mesentery, on the other hand, is very sensitive, and tension on it produces severe pain.

Observations in animals.—In contrast to the surgical experience stand the records of the physiologists. Sherrington (1906), in his analysis of the sensory fields of the body, recognized an intero-receptor field including the intestine. Trauma to the viscera, including the intestine, elicits widespread reflex activities in experimental animals. Mention may be made of changes of arterial pressure, movements of limbs, contraction of abdominal muscles, alterations of breathing, dilatation of the pupil, and inhibition of mobility of the rest of the intestine and of the knee jerk.

Effective stimuli.—The stimuli which affect visceral nerve endings in animal experiments have been listed most fully for the intestine. Distension with a balloon is a commonly used stimulus, which will also produce pain in man. Other effective stimuli include mechanical agents, as cutting or pinching; physical agents, as heating above 46° C.; and chemical agents, as the application of 10 per cent. saline, isotonic potassium chloride, or dilute hydrochloric acid (Downman, McSwiney and Vass, 1947). These agents have been effective only when applied to the outer surface of the gut, application to the mucosa eliciting no reflex responses of the animal. It is

probable that the affected nerve endings lie in or just beneath the serosa, since scratching the latter was effective. It must be admitted that such agents would not normally approach the intestine and they may represent no more than non-specific stimuli to nerve fibres.

Hurst (1911) suggested that tension in the wall of the intestine is the only stimulus which can affect pain endings in the intestine. Distension and spasm of the gut produce both pain and reflex changes in man. Hurst explained the apparent insensitivity of the gut to trauma, such as cutting, by failure to apply the adequate stimulus—tension. Lewis (1942) points out, however, that mechanical trauma could scarcely fail to excite pain fibres, if such exist in the intestine, as it excites nerve fibres elsewhere in the body. Lewis and Kellgren (1939) were unable to elicit contraction of abdominal muscles on pinching the intestine, whereas pinching the pancreas was effective. Lewis (1942) argues that the intestine lacks a system of afferent fibres and suggests it is the pain-perceiving system, to accord with surgical experience. Recently, however, it has been shown that the absence of visceromotor responses depends upon the condition of the animal, these reflexes quickly disappearing if the abdominal cavity is disturbed or the intestine stimulated frequently (Downman and McSwiney, 1946). Absence of a reflex does not prove absence of the pain network.

The source of intestinal nerve impulses.—It is conceivable that stimuli which are considered to act on the intestine produce their effects only if they spread on to adjacent mesentery, the latter being the real source of afferent impulses. Certainly the intestinal mesentery is sensitive and can be a source of pain. Meyer (1919) concluded that distension and spasm did not cause pain if the mesentery was protected from stretch. On the other hand, the mechanical and chemical agents listed above are still effective stimuli when all possibility of spread to the mesentery is prevented.

It may be postulated that discrepancies between the findings in man and animals depend upon the use of different indices for visceral afferent impulses. The surgeon is concerned with pain, and his results indicate the extent of the pain-perceiving system. The physiologist records reflexes, and reflexogenic impulses are not necessarily painful impulses. In this instance, the normal function of the afferent impulses is unknown. It should be noted that distending a balloon in the duodenum elicits vasoconstriction in the digits before sensation (Carmichael, Doupe, Harper, McSwiney, 1939).

The electro-physiological approach.—Using modern amplifier methods, together with cathode-ray oscillography, it is possible to record the electrical changes in nerves of the intestine as nerve impulses travel towards the spinal cord. These studies show that trauma to the intestine, such as pinching, provokes a stream of impulses up fine nerve fibres in the mesenteric nerves. The impulse pattern is of interest because it suggests that the responsible fibres resemble those which subserve pain sensation in the skin. The electrical studies will give much information of the type of nerves innervating the intestine and the destination of their impulses.

PAIN OF VISCERAL ORIGIN

There is no denying that visceral disorder may cause pain. The pain is usually ill-defined and may be characterized as aching or boring. Usually in the midline, it tends to be referred segmentally. The pain may also be referred to a place far from the organ at fault. A classical example of this is the pain at the shoulder tip which is caused by rubbing the under side of the diaphragm. It is rarely possible to localize visceral pain in the affected viscus. Pains from organs in the upper part of the abdomen, including the small intestine, are located above the umbilicus, whereas pains from organs in the lower abdomen, such as colon and bladder, are located below the umbilicus. Whether the affected organ lies to right or left of the midline the sensation is usually midline. Accurate localization of the pain over the organ is generally explained by extension of the disease process to the parietal peritoneum.

The rôle of the splanchnic nerves.—After resection of splanchnic nerves and lumbar sympathetic chains, distension of the jejunum does not cause any pain. Furthermore, resection of the nerves on one side abolishes the pain on that side of the midline (Bentley and Smithwick, 1940). Stimulating the central end of a splanchnic nerve in man causes unilateral pain (Foerster, 1927). The bilateral nature of the pain seems to depend upon simultaneous entry of impulses into both sides of the cord.

Local analgesia.—Reports concerning the effect of local analgesia of the body wall upon referred visceral pain are confusing. As regards the pain in the shoulder tip caused by diaphragmatic irritation, there are reports that the pain is abolished by infiltrating the skin and subcutaneous tissues at the shoulder tip with local analgesics (Morley, 1931). This has been denied. Woollard, Roberts and Carmichael (1932) elicited the shoulder-tip pain by pinching the phrenic nerve in the neck; local analgesia in the painful area did not alter the character or intensity of the pain. Accounts are still given, however, of abolition of pain by local analgesia. Many of the reports state that analgesia of the skin causes the pain to shift, whilst wider infiltration results in less intense pain becoming evident at some distance from the first. Some consider this to be an unmasking of a deeper visceral component, others think that removal of the focus of severe pain allows the subject to appreciate the full limits of the sensation. Visceral pain is frequently referred to operation scars. Whatever may be the effect of local analgesia, its experimental use must be very carefully controlled to eliminate all possibility that the pain may be altered by such factors as suggestion, spread beyond the pain area, and so on.

The effect of inflammation.—Lennander (1902) and others have found that the inflamed intestine is as insensitive to trauma as the non-inflamed intestine. Wolf and Wolff (1943) were able to stimulate gastric mucosa through a permanent gastrostomy opening. The normal mucosa was insensitive to irritants and to pinch. When the inflamed mucosa, however, was tested, pain was produced. It is of interest that with repeated testing the

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error in localizing the stimulated place decreased appreciably. Kinsella (1940) found that squeezing the inflamed appendix caused pain, but one cannot be sure that this was not due to an action on the sensitive appendicular mesentery.

HYPOTHESES CONCERNING VISCERAL PAIN

Lewis (1942) summarizes the types of visceral pain, which have been described as follows. First, true visceral pain—arising from, and localized in, a viscus. Secondly, visceral referred pain—arising directly or indirectly out of afferent impulses from a viscus and referred segmentally. Thirdly, parietal referred pain—due to stimulation of parietal wall and referred segmentally. Fourthly, parietal local pain—due to spread of disease from the viscus to the parietal wall. Individual views on the problem of the mechanism of visceral pain will depend upon how many of these types of pain are accepted. It may be pointed out that the first three types of pain are all the same pain to the patient. The differences are only in the observer's views on the origin and reference of the pain. The fourth type represents accurate localization over the diseased viscus, and there is general agreement about its mechanism.

Ross (1888) believed that the viscera are sensitive and are the origin of both true and referred visceral pain. The former depends upon ascending tracts conveying visceral afferent impulses. The latter is produced by visceral afferent impulses activating ascending tracts subserving body wall sensation, by an extension of "commotion" within the grey matter of the spinal cord—an idea introduced by Sturge in 1883 to account for the reference of pain in angina pectoris. This could account also for local hyperalgesia accompanying visceral disorder.

Lennander (1902) maintained that the viscera are insensitive. All painful sensation from disorders of viscera originate in the parietal peritoneum and its subserous layer, which is supplied with cerebrospinal sensory nerves. Mackenzie (1920) also rejected Ross's suggestion of true visceral pain, but acknowledged visceral referred pain. This latter is due to painless impulses from the viscus which spread in the spinal grey matter to activate tracts subserving pain of the body wall, to which the sensation is referred. Mackenzie's use of the term "viscero-sensory reflex" for the process is unfortunate, because it does not represent a reflex in the physiological sense. Cutaneous hyperalgesia was explained by impulses from the viscus producing an irritable focus in the cord which lowered the threshold for conduction of impulses from the body wall. Muscular rigidity accompanying visceral disease was supposed to depend upon a viscero-motor reflex—reflex contraction of abdominal muscles receiving their nerve supply from the same spinal segments as the viscus.

Morley (1931) is convinced that true visceral pain exists as a result of abnormal tension on sensory endings in viscera. It is a vague, deep-seated

central pain not accurately localized. Referred pain originates from the parietal peritoneum. Tenderness and rigidity also result from stimulation of the cerebrospinal nerves of the parietal peritoneum, two closely related mechanisms being involved, namely peritoneo-muscular reflexes and peritoneo-cutaneous radiation. These replace the visceromotor and viscerosensory reflexes of Mackenzie.

The most recent critical approach to the problem is that of Lewis, as outlined in "Pain" (1942). He notes the resemblance between pain originating in abdominal and thoracic viscera, and that provoked by injury to deep tissues of the body wall, such as muscles. In both instances the pain is ill-defined and tends to be referred segmentally. He argues that the sensory fields of the body can be divided into the superficial, or skin, and a deep field. Cortical representation of the former is well localized and recognition of the site of a stimulus is accurate. The latter is represented in the cortex as segments of the body, and the cortex tends to refer all sensation to the whole segment, whatever structure in it—muscle or mesentery—is the source of the painful impulses. It may be noted that although Lewis accepts the pain sensitivity of some viscera, such as ureter and mesentery, he regards the intestine as insensitive. Pain apparently provoked by intestinal manifestation is supposed to be due to stimulation of the sensitive mesentery.

It is evident that at the present time no one hypothesis can be selected and that further observations are required before the mechanism is understood.

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REVISION CORNER

THE TREATMENT OF PAROXYSMAL TACHYCARDIA

PAROXYSMAL tachycardia is an abnormal heart rhythm met with at any age. It is characterized by sudden onset and offset. The usual rate is between 150 and 200 but the limits are 110 and 250. The new focus originates in the auricle, A-V node, or ventricle. Paroxysmal auricular fibrillation or flutter are not included here as they are generally regarded as separate entities. Familiarity with the natural behaviour of paroxysmal tachycardia is essential for proper assessment of any treatment. Although the arrhythmia tends to be constant in frequency and duration in a particular patient, attacks are often haphazard in their coming and going, making it impossible to predict when an attack will end, and the last remedy used may be wrongly given the credit. There is no infallible remedy.

GENERAL MANAGEMENT

This varies with the stage at which the patient is first seen. If attacks have been frequent and well borne for years, as is usual, the physician can be confident in his assurance that the present and future attacks will not be dangerous. When the patient is seen in the first paroxysm or soon after, caution in prognosis is necessary, especially in older people, for the new rhythm may mean the start of organic heart disease, particularly coronary disease, and future attacks may precipitate congestive heart failure. Anginal pain is suspect, despite the fact that cardiac pain can arise in any form of paroxysmal tachycardia. Rheumatic heart disease, coronary disease, hypertension and thyrotoxicosis, in that order of incidence, may underlie the arrhythmia, which is nevertheless surprisingly well borne in most cases and justifies reassurance. When a paroxysm begins during the course of an acute illness, like broncho-pneumonia, the outlook is serious and emboli from intracardiac thromboses may be fatal.

An electrocardiogram should be secured if possible during an attack, but if isolated extrasystoles are noted at other times a tracing may indicate the source of the new focus in auricle or ventricle. Ventricular paroxysmal tachycardia is as a rule more serious than the auricular type because of its common association with coronary disease; fortunately it is much the rarer. Its special danger is ventricular fibrillation.

Most patients, however, have no underlying heart disease and the ectopic pacemaker is in the auricle. Attacks are then more of a nuisance than of serious import, as the patient often discovers for himself. He avoids conditions which experience has taught him bring on paroxysms—heavy meals, violent exertion, over-smoking, excessive alcohol, emotional upset, or sudden change of posture. He may learn to stop attacks by mechanical methods outlined below, or to minimize their effect. The more stoical patient may be able to ignore attacks and continue his occupation, if necessary, during them. Attacks rarely last more than ten days and the average length is only two hours; facts worth remembering. Increasing length and rapidity of seizures may indicate progressive myocardial disease, and paroxysmal fibrillation or flutter may alternate with or replace paroxysmal tachycardia. Any measure which improves the general health (for example, removal of septic foci) needs attention, and treatment of masked hyperthyroidism must not be overlooked.

METHODS OF STOPPING AN ATTACK

Mechanical.—Direct stimulation of the vagus may induce the sinus node to resume dominance, particularly in paroxysmal auricular tachycardia.

- (1) Taking a deep breath and holding it for as long as possible, or taking a deep breath and expiring against a closed glottis.
- (2) Sitting or lying with the head down.

(3) Pressure for a few seconds on one or, if necessary, both eyeballs; pressure should be firm enough to cause pain, although pain is not the effective stimulus.

(4) Pressure for 20 seconds on the right or left carotid sinus. The last two methods are especially effective during anaesthesia but more often fail than succeed at other times.

(5) Tickling the back of the throat with intent to induce vomiting, or taking an emetic for the same purpose.

(6) Swallowing ice or applying ice to the præcordium.

Drugs: Quinidine by mouth, 5 grains (0.3 gm.) two-hourly, for six doses. A watch is kept for cinchonism and electrocardiographic control is desirable. Perhaps half the cases which do not respond to mechanical methods will do so to quinidine by mouth. *Quinidine intravenously*: If it is necessary to stop an attack because of impending or early congestive heart failure, 3 grains (0.2 gm.) given slowly may occasionally end the paroxysm while the needle is still in the vein. Care is required to avoid thromboses at the site of injection, for paroxysmal tachycardia predisposes to that event. *Quinine hydrochloride intramuscularly*, 6 to 8 grains (0.4 to 0.53 gm.), repeated if required in four hours. Aseptic technique is absolutely essential to avoid muscle necrosis.

The mode of action of these drugs in paroxysmal tachycardia is obscure. Happily quinidine is most efficient in the ventricular type. When a paroxysm results from coronary thrombosis, quinidine by mouth and, if indicated, intravenously, should not be delayed for longer than a few hours.

Digitalis group: Some deny the efficacy of digitalis but no patient should die of paroxysmal tachycardia with digitalis untried, more especially if there is any question of 1:1 flutter. A few patients do switch over to normal rhythm on full dosage, 6 to 10 grains (0.4 to 0.6 gm.) of the leaf daily, for four or five days. If a patient habitually suffers prolonged attacks with incipient or actual congestion, digitalis by mouth should be used early if quinidine has failed. Strophanthin, 1/100 grain (0.65 mgm.), or digoxin, 0.5 mgm., intravenously, may be tried in auricular paroxysmal tachycardia, but they are dangerous in the ventricular type, and must not of course be given when digitalis has recently been taken by mouth.

Magnesium sulphate, 20 c.cm. of 20 per cent. solution, intravenously, is a more recent remedy which promises well. Transient conduction defects and extrasystoles may follow. *Mecholyl chloride* (acetyl- β -methylcholine chloride) 30 mgm., subcutaneously or intramuscularly, is usually successful in young patients but should be avoided if coronary disease is suspected.

Other measures.—Congestive heart failure may need venesection, mercurial diuretics and restricted fluids. Congestion may, however, be purely mechanical, due to simultaneous contraction of auricles and ventricles at rapid rates and, unless there is underlying heart disease and the congestion is progressive and severe, the outlook is not serious because all signs of congestion vanish within a few hours from the end of the paroxysm.

PREVENTION OF ATTACKS

Quinidine is the drug of choice. All patients do not benefit, but if dosage is adapted to the needs of the individual more successes will result. The usual dose of 3 grains (0.2 gm.), thrice daily, may not be enough, and 10 grains (0.6 gm.), or even 15 grains (0.9 gm.), thrice daily, may be effective. Such treatment can be beneficial for years, and intolerance is rare.

Digitalis.—If quinidine fails, digitalis leaf, 1 to 2 grains (0.06 to 0.13 gm.) daily, may prevent attacks. It may be necessary to give larger doses. There is a risk of inducing paroxysms of auricular fibrillation or flutter, but quinidine may then restore normal rhythm.

Sedatives.—Having regard to the important influence of emotion in provoking

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This varies with the stage at which the patient is first seen. If attacks have been frequent and well borne for years, as is usual, the physician can be confident in his assurance that the present and future attacks will not be dangerous. When the patient is seen in the first paroxysm or soon after, caution in prognosis is necessary, especially in older people, for the new rhythm may mean the start of organic heart disease, particularly coronary disease, and future attacks may precipitate congestive heart failure. Anginal pain is suspect, despite the fact that cardiac pain can arise in any form of paroxysmal tachycardia. Rheumatic heart disease, coronary disease, hypertension and thyrotoxicosis, in that order of incidence, may underlie the arrhythmia, which is nevertheless surprisingly well borne in most cases and justifies reassurance. When a paroxysm begins during the course of an acute illness, like broncho-pneumonia, the outlook is serious and emboli from intracardiac thromboses may be fatal.

An electrocardiogram should be secured if possible during an attack, but if isolated extrasystoles are noted at other times a tracing may indicate the source of the new focus in auricle or ventricle. Ventricular paroxysmal tachycardia is as a rule more serious than the auricular type because of its common association with coronary disease; fortunately it is much the rarer. Its special danger is ventricular fibrillation.

Most patients, however, have no underlying heart disease and the ectopic pacemaker is in the auricle. Attacks are then more of a nuisance than of serious import, as the patient often discovers for himself. He avoids conditions which experience has taught him bring on paroxysms—heavy meals, violent exertion, over-smoking, excessive alcohol, emotional upset, or sudden change of posture. He may learn to stop attacks by mechanical methods outlined below, or to minimize their effect. The more stoical patient may be able to ignore attacks and continue his occupation, if necessary, during them. Attacks rarely last more than ten days and the average length is only two hours; facts worth remembering. Increasing length and rapidity of seizures may indicate progressive myocardial disease, and paroxysmal fibrillation or flutter may alternate with or replace paroxysmal tachycardia. Any measure which improves the general health (for example, removal of septic foci) needs attention, and treatment of masked hyperthyroidism must not be overlooked.

METHODS OF STOPPING AN ATTACK

Mechanical.—Direct stimulation of the vagus may induce the sinus node to resume dominance, particularly in paroxysmal auricular tachycardia.

(1) Taking a deep breath and holding it for as long as possible, or taking a deep breath and expiring against a closed glottis.

(2) Sitting or lying with the head down.

(3) Pressure for a few seconds on one or, if necessary, both eyeballs; pressure should be firm enough to cause pain, although pain is not the effective stimulus.

(4) Pressure for 20 seconds on the right or left carotid sinus. The last two methods are especially effective during anaesthesia but more often fail than succeed at other times.

(5) Tickling the back of the throat with intent to induce vomiting, or taking an emetic for the same purpose.

(6) Swallowing ice or applying ice to the præcordium.

Drugs: Quinidine by mouth, 5 grains (0.3 gm.) two-hourly, for six doses. A watch is kept for cinchonism and electrocardiographic control is desirable. Perhaps half the cases which do not respond to mechanical methods will do so to quinidine by mouth.

Quinidine intravenously: If it is necessary to stop an attack because of impending or early congestive heart failure, 3 grains (0.2 gm.) given slowly may occasionally end the paroxysm while the needle is still in the vein. Care is required to avoid thromboses at the site of injection, for paroxysmal tachycardia predisposes to that event. *Quinine hydrochloride intramuscularly*, 6 to 8 grains (0.4 to 0.53 gm.), repeated if required in four hours. Aseptic technique is absolutely essential to avoid muscle necrosis.

The mode of action of these drugs in paroxysmal tachycardia is obscure. Happily quinidine is most efficient in the ventricular type. When a paroxysm results from coronary thrombosis, quinidine by mouth and, if indicated, intravenously, should not be delayed for longer than a few hours.

Digitalis group: Some deny the efficacy of digitalis but no patient should die of paroxysmal tachycardia with digitalis untried, more especially if there is any question of 1:1 flutter. A few patients do switch over to normal rhythm on full dosage, 6 to 10 grains (0.4 to 0.6 gm.) of the leaf daily, for four or five days. If a patient habitually suffers prolonged attacks with incipient or actual congestion, digitalis by mouth should be used early if quinidine has failed. Strophanthin, 1/100 grain (0.65 mgm.), or digoxin, 0.5 mgm., intravenously, may be tried in auricular paroxysmal tachycardia, but they are dangerous in the ventricular type, and must not of course be given when digitalis has recently been taken by mouth.

Magnesium sulphate, 20 c.cm. of 20 per cent. solution, intravenously, is a more recent remedy which promises well. Transient conduction defects and extrasystoles may follow. *Mecholyl chloride* (acetyl- β -methylcholine chloride) 30 mgm., subcutaneously or intramuscularly, is usually successful in young patients but should be avoided if coronary disease is suspected.

Other measures.—Congestive heart failure may need venesection, mercurial diuretics and restricted fluids. Congestion may, however, be purely mechanical, due to simultaneous contraction of auricles and ventricles at rapid rates and, unless there is underlying heart disease and the congestion is progressive and severe, the outlook is not serious because all signs of congestion vanish within a few hours from the end of the paroxysm.

PREVENTION OF ATTACKS

Quinidine is the drug of choice. All patients do not benefit, but if dosage is adapted to the needs of the individual more successes will result. The usual dose of 3 grains (0.2 gm.), thrice daily, may not be enough, and 10 grains (0.6 gm.), or even 15 grains (0.9 gm.), thrice daily, may be effective. Such treatment can be beneficial for years, and intolerance is rare.

Digitalis.—If quinidine fails, digitalis leaf, 1 to 2 grains (0.06 to 0.13 gm.) daily, may prevent attacks. It may be necessary to give larger doses. There is a risk of inducing paroxysms of auricular fibrillation or flutter, but quinidine may then restore normal rhythm.

Sedatives.—Having regard to the important influence of emotion in provoking

Sodium salicylate is a much less effective and pleasant analgesic than aspirin, and its use should be reserved for the treatment of acute rheumatism.

PETHIDINE

This drug is also known as demerol and dolantin. It has a definite analgesic action, the intensity of its effect lying between that of the aromatic analgesics and morphine. It does not cause vomiting or affect the respiratory centre, but it may produce dizziness. In addition, however, it relaxes spasm in smooth muscle and also has a slight hypnotic action. It thus appears to be particularly suitable for the treatment of colic, whether intestinal, ureteric or biliary. It has been used with success in post-operative and other types of pain. Tolerance does not seem to develop, and cumulation does not arise, but an increasing number of cases of addiction are being reported and it is wise not to use it for long periods. It is of value in obstetrics and is said to shorten the duration of normal labour. Although a dose of 25 mgm. will often give an effect, the usual certainly effective dose is 100 mgm. by mouth or by intramuscular injection. The duration of its effect is less than that of morphine but it is advisable that not more than 400 mgm. should be given in twenty-four hours.

COMBINATIONS OF ANALGESIC DRUGS

There is probably no other field of therapy in which the phenomenon of alleged synergism has been so widely exploited by the manufacturers of proprietary remedies. It is, in fact, possible to justify the use of combinations of the aromatic analgesics since their toxic effects are different, and it is conceivable that the addition of caffeine or codeine may enhance the efficiency of the preparation. One such preparation—the compound tablet of codeine B.P.C.—is an imitation of a well-known proprietary remedy. It contains 4 grains (0.25 gm.) each of aspirin and phenacetin and $\frac{1}{4}$ of a grain (8 mgm.) of codeine phosphate. It should be noted that two such tablets contain a dose of the aromatic analgesics greater than three tablets of aspirin or phenacetin and that the alleged greater efficiency of the preparation may be in part due to this fact.

Since pain is so often accompanied by insomnia, it is not surprising that many attempts have been made to imitate the action of morphine by combining the aromatic analgesics with barbiturates, which themselves have a very poor analgesic effect unless given in doses sufficient to cause unconsciousness. The objections to such preparations are twofold. In the first place, far too many contain amidopyrine as the analgesic constituent and an attempt is sometimes made to hide its true nature from the prescriber by describing it on the package as dimethylamino-phenyl-dimethyl-isopyrazolone. In the second place, the barbiturate is usually one of the longer acting group, such as barbitone itself, and since the effect of the analgesic is as a rule short lived, and the dose therefore frequently repeated, a cumulative effect may easily occur. The practitioner should himself choose the appropriate analgesic and hypnotic and prescribe them separately in their appropriate doses at the correct intervals. If the advantage of a single tablet is felt to be very great, the least objectionable preparations at present available are sonalgin, containing butobarbitone, codeine and phenacetin (May & Baker), and aspirin and amytal capsules (Eli Lilly).

PROFESSOR E. J. WAYNE, M.D., PH.D., F.R.C.P.

NOTES AND QUERIES

The Treatment of Athlete's Foot

QUERY.—On page 274 of the October, 1946, the mention is made of the use of phenolphthor mixture in the treatment of ringworm of the foot. May this treatment now be prescribed with confidence for fresh cases of athlete's foot? What course of treatment is now generally recommended by dermatologists? What advice on prophylaxis can be given to those likely to be exposed to the risk of infection?

REPLY.—As was pointed out in the article referred to, although Phillips in the *Brit. J. Derm. Syph.*, 1944, 56, 219, published good results and no ill-effects from the phenolphthor treatment, on the other hand numerous warnings and unsatisfactory results have been published by other users. I would not say that the treatment might be "prescribed with confidence for fresh cases of athlete's foot". I have no personal experience of it myself and I am accustomed to rely on one or other of the following applications:—

- | | |
|---|-----------------|
| a) Dithranol | 2 parts |
| Chloroform | 12 parts |
| Benzene (B.P.) | to 100 parts |
| To be painted on twice daily. | |
| If the skin is hyper-sensitive to dithranol I use:— | |
| b) Benzoic acid | 6 parts |
| Salicylic acid | 6 parts |
| Chlorethone | 2 parts |
| Hydrous ointment (B.P.) | to 100 parts |
| sometimes alternated with | |
| c) Salicylic acid | 12 parts |
| Benzoic acid | 12 parts |
| Acetone and Industrial spirit | 25 to 100 parts |
| d) Castellani's fuchsin paint. | |

When using any of the paints I have mentioned, a dusting powder of

- | | |
|----------------------|--------------|
| Salicylic acid | 2 parts |
| Talc powder | to 100 parts |

may be used between the toes when the paint is dry.

As regards prophylaxis, the application of a salicylic and benzoic acid ointment, half the strength mentioned in prescription (b), is useful.

A. C. ROXBURGH, M.D., F.R.C.P.

Rectal Pain in a Child

QUERY.—I have a child patient of about four years of age who complains of pain in the rectum, not necessarily when defaecating. There is no fistula nor are there any piles present. I should be glad if you could indicate some possible causes which I might investigate.

REPLY.—This is a rare complaint in a child of four. It is well to be certain that the child really feels the pain in the rectum, which is poorly

supplied with sensory nerves and is rarely the seat of pain, and not in the urinary bladder or the sacrum. To exclude any lesion of the rectum an electrically illuminated proctoscope should be passed. If a foreign body such as a fish bone were present it could be seen and extracted. I have removed from the rectal wall a sewing needle with thread attached, which was giving rise to local discomfort and no other symptoms. In the absence of any local pathological changes a search must be made for any possible cause of referred pain. An X-ray examination of the lumbar and sacral spine will show the presence or absence of a spina bifida occulta (which rarely gives rise to symptoms before the age of ten or twelve) or a localized osteitis of the sacrum.

SIR LANCELOT BARRINGTON-WARD, K.C.V.O.,
CH.M., F.R.C.S.

The Desensitization Treatment of Asthma

QUERY.—I should be grateful for advice in the following case:—The patient, aged fifty-six, has chronic bronchitis. X-rays show some fibrosis, with emphysema. During the past three years, from about the middle of May until the end of July, the patient has had severe asthma. He lives in the country, and during the above period a visit to the orchard produces exacerbation of symptoms. His asthma disappears when he goes to the seaside in August, and would therefore seem to depend upon the inhalation of a specific grass pollen. What antigen should be used to try to prevent a recurrence of symptoms this summer, and in what doses?

REPLY.—Before the question of desensitization treatment is considered, it is necessary to establish the specific diagnosis of the suspected pollen allergy by means of skin tests. The time of onset and the duration of the asthma correspond with the pollinating season of the grasses; so, in order that the query proper can be answered, we will assume (1) that the skin tests show a sensitivity to grass pollen, and (2) that the asthma is due solely to the pollen sensitization. In view of a number of unusual features in the history, a council of perfection would be to have an allergic and bacteriological overhaul carried out first. For desensitization treatment pollaccine (P.D.) grass pollen extract would be suitable. In view of the time limit of four weeks until the grass pollinating season starts, a combination of pre-seasonal and co-seasonal treatment would be best. I suggest 20, 40, 60, 80, and so on, units of pollaccine,

by subcutaneous injection, at two- or three-day intervals until about the 20th May. This scheme of dosage may, of course, require to be modified should focal or marked local reactions occur. Then give one half of the highest dose reached, at about one-week intervals until the end of July. This maintenance dose is best given in the evening of a cool or wet day—when the pollen cloud is at its minimum—and should be mixed with a small amount of adrenaline, e.g. 0.1 c.c.m. of a 1-t,000 solution. Should the action of the desensitization treatment need to be fortified during the pollen season, the following palliatives might be suitable: Franeol tablets (Bayer: a combination of ephedrine, theophylline, and a small amount of luminal), or one of the adrenaline inhalant preparations.

DAVID HARLEY, M.D

Referred Cardiac Pain

QUERY.—The pain of heart disease is said to be "referred" to various parts of the skin. Exactly what segments of the cord take part in this phenomenon and what are the nerves involved in the relay?

REPLY.—Pain from the heart may be conveyed through the superior, middle and inferior cardiac nerves above and along the three direct thoracic cardiac nerves below, into the paravertebral sympathetic chain whose three main stations are named the superior, middle and inferior cervical ganglia. Thence, sensation travels by the white rami communicantes along the posterior spinal roots of the upper four thoracic nerves.

WILLIAM EVANS, M.D., F.R.C.P.

Hyperthyroidism and the "Anxiety State"

QUERY.—I shall be grateful for enlightenment on the following points arising out of Dr. Gardiner-Hill's article in the October, 1946, number. On page 311, a series of symptoms due to hyperthyroidism is described. Further on, the cause of hyperthyroidism is given as "anxiety", and a difference is implied between "anxiety" and "anxiety state". I should be most grateful to know:—(1) How to differentiate between hyperthyroidism and an "anxiety state" producing similar symptoms? (2) Whether it is of any use treating the hyperthyroidism in a chronic and incurable case of anxiety? (3) The modern treatment of hyperthyroidism? (4) Whether an "anxiety state" can produce other endocrine symptoms, e.g. reactionary hyperinsulinism, mentioned later in the article?

REPLY.—The term "anxiety state" in the paragraph of my article mentioned, referred to the

condition we know as a psychoneurosis. I referring to "hyperthyroidism" I intended to convey that the condition was one with physical symptoms—usually an enlarged thyroid, change in its vascularity, signs of raised metabolism, loss of weight, eye signs, and so on. As we all know, hyperthyroidism is often produced by worry or anxiety. I do not think that the symptoms of a psychoneurosis and hyperthyroidism are similar but certainly when, say, an emotional tachycardia is the chief feature of the psychoneurosis it may be difficult to decide in which case a basal metabolism test is probably the best guide or an iodine remission test which if carried out under controlled conditions, will usually settle the question of hyperthyroidism.

If hyperthyroidism is present, I should be all in favour of treating it. I think it is better to treat the physical condition of hyperthyroidism before dealing with any worries, although there is no reason why the latter should not be allayed if possible at the same time. The modern treatment of hyperthyroidism is either medical, with thiouracil or one of the anti-thyroid preparations, or a subtotal thyroidectomy. In my view, medical treatment is more useful and more successful with the early cases and for those occurring in young individuals. In established hyperthyroidism, and particularly when complications such as eye signs or auricular fibrillation are present, subtotal thyroidectomy seems to me to produce better results.

I am of the opinion that reactionary hyperinsulinism is due to an excessively high carbohydrate diet and that was the sense in which the term was used in my article. The question whether hypoglycaemia can be produced by anxiety is a very difficult problem. I think more evidence is necessary before a definite view can be established.

H. GARDINER-HILL, M.D., F.R.C.P.

The Treatment of Undeveloped Breasts

QUERY.—A patient of mine, a professional "model", is anxious to increase her mammary development. She is thirty-two, and had bilateral salpingectomy done at the age of nineteen, the ovaries being left *in situ*. Her periods are normal and regular. Is there any reliable endocrine treatment which is safe to employ, and if so what dosage is recommended?

REPLY.—The breasts may be too small for any of the following reasons: (1) There may be a local insensitivity to the action of the ovarian hormones; (2) there may be a deficiency of this hormone owing to under-activity of the ovaries; (3) there may be a general pituitary deficiency with consequent lack of the gonadotrophic hormone.

The treatment of the pituitary deficiency is unsatisfactory, but the particular symptom of which the patient complains can be successfully attacked by replacing the missing ovarian secretions. The most satisfactory way of doing this is by local inunction of an oestrogenic ointment, combined with the oral use of ethisterone. Ethisterone is best given only during the luteal phase of her menstrual cycle. A considerable increase in the size of the breasts is often obtained. If the deficiency is ovarian the same treatment may be employed with again a good

chance of success. The vast majority of patients, however, who complain of this symptom are suffering from a purely local defect. They show no signs of any pituitary or ovarian deficiency. They menstruate regularly and normally and produce children, although they often cannot lactate satisfactorily. There is no satisfactory treatment in these cases. It is possible that relatively enormous doses of ovarian hormone might overcome the local insensitivity, but such treatment may have unwanted side-effects.

RAYMOND GREENE, D.M., M.R.C.P.

PRACTICAL NOTES

Penicillin in Diphtheria

THE results of an investigation into the use of penicillin in the treatment of acute diphtheria and of the chronic diphtheria carrier is recorded by L. Weinstein (*American Journal of the Medical Sciences*, March 1947, 213, 308). Twelve patients with acute diphtheria were treated with antitoxin alone (5,000 to 60,000 units; average, 40,000), and in them the time required for the disappearance of the organism from the nose and pharynx was 17 to 75 days (average, 33.25 days). Twenty-six patients with acute diphtheria were treated with antitoxin (20,000 to 80,000 units; average, 31,350) plus penicillin (15,000 to 30,000 units intramuscularly every three hours for an average of 15 days), and in them the time required for the disappearance of the organism from the nose and pharynx was 1 to 14 days (average, 3.96 days). Penicillin had no effect upon the clinical course of the disease. In the case of 13 chronic diphtheria carriers it was found that a minimum dose of 30,000 units of penicillin intramuscularly every three hours (i.e., 240,000 units daily) for 12 days resulted in disappearance of the organism in 3 to 5 days. The conclusion is drawn that "the value of penicillin in the therapy of diphtheria appears to be its ability to shorten markedly the duration of the convalescent carrier state. There is no indication that penicillin has any beneficial effect on the clinical course of the disease, and its use does not eliminate the necessity of giving adequate quantities of antitoxin. The chronic diphtheria state may be cured if adequate amounts of penicillin are administered parenterally".

Vitamins and Hormones in Senility

IN an investigation into the effects of vitamins and hormones on senile patients, carried out at the Laboratory for Clinical Research on Ageing, at the Tooting Bec Hospital, P. E. Vernon and M. McKinlay (*Journal of Neurology, Neurosurgery and Psychiatry*, July 1946, 9, 87) were

unable to obtain evidence of "any general improvement in intellectual efficiency or psychomotor capacities as a result of the treatment". Eighty-four male senile patients were included in the series, and three different courses of treatment were used: (a) small doses of vitamins B and C; (b) larger doses of these two vitamins; (c) 75 mgm. of methyl testosterone by mouth every day for four weeks. "A large battery of mental and psychomotor tests" was used. The vitamin treatment produced slight indications of improvement in general intelligence tests with a decrease in perseveration tendencies in the milder cases, but these findings were considered to be of slight statistical significance. The hormone treatment was apparently quite ineffective. It is pointed out that one of the factors probably responsible for these slight responses may have been that the patients were already having an adequate diet. Larger or more homogenous groups of patients are clearly required in order to confirm these observations.

Vitamin D Intoxication

THE importance of recognizing the clinical symptoms of intoxication in children undergoing treatment with vitamin D in high dosage is stressed by R. Houet (*Revue Médicale de Liège*, April 1, 1947, 2, 171) who records several personally observed cases. High dosage of vitamin D may act in two ways:—first by a mobilization of the osseous salts which leads to increasing calcæmia with resultant anorexia and vomiting; secondly, directly on the kidney, leading to an increase of blood urea and hypertensive nephritis. In the infant the clinical picture is one of increasing pallor, apathy, anorexia with vomiting, and excessive thirst. The urine contains traces of albumin, and the blood shows an increase in calcium, phosphorus and urea. In all infants receiving vitamin D in high dosage a calcium titre above 12 mgm. (direct Kramer-Tisdall precipitation) or phosphatæmia above 6 is an indication for action.

The therapy must be stopped immediately: on cessation of administration of vitamin D the symptoms rapidly disappear. Should the symptoms not disappear this may indicate the onset of meningitis; and particularly in infants who are being treated for a bacillary lesion the symptoms of vitamin D intoxication may mask an oncoming meningitis. Herein is a point of diagnostic significance. That the risk of vitamin D intoxication is not confined to children is shown by the report by P. Vallery-Radot, P. Milhez and A. Ryckewaert (*Bulletin et Mémoires de la Société Médicale des Hôpitaux de Paris*, December 1946, 62, 612) of three cases in adults of twenty-two, twenty-eight and forty-six years, taken from a number of cases of vitamin D intoxication observed during a period of some months. All three patients were receiving vitamin D₂ in high dosage for the treatment of tuberculous affections. The symptoms of intoxication included disturbance of water metabolism, renal insufficiency, digestive, nervous and cardiovascular disturbances, and anaemia. Although as a rule the symptoms of intoxication disappear with cessation of therapy, they may be serious or even fatal. These authors state that the toxic dose varies with the individual, but that oral administration is better tolerated than administration by intramuscular injection.

Chorionic Gonadotropin in the Treatment of Enuresis

A series of 16 cases of enuresis in children of ages ranging from three to thirteen years in whom urinary findings were negative and to whom chorionic gonadotropin was administered is recorded by M. S. Giolfari and H. G. Clark (*Archives of Pediatrics*, February 1947, 64, 61). In practically all cases previous treatment had been undergone without success. Chorionic gonadotropin (Intuntrin-S; (Parke, Davis & Co.,) 500 units per c.c.m.) was given in initial dosage of 0.1 c.c.m., twice weekly, the dose being increased according to tolerance to a maximum of 1 c.c.m., twice weekly; 0.1 c.c.m. to 0.2 c.c.m. were given intradermally and the remainder subcutaneously. The usual limit was to six injections. No other medication and no orders were given. The method was adopted with the object of impressing on the mother, and still more on the subconscious mind of the child, that cure was going to be obtained, while at the same time the gonadotropin was developing the genito-urinary system. The treatment was continued until at least one week had passed without bed-wetting. Of the sixteen children treated 7 were cured, 8 improved, and in 1 case the treatment was unsuccessful. The cured cases

were mostly in the older age group: those classified as improved showed a definite betterment of the condition, i.e., whereas bed-wetting before treatment was three to five times weekly or even nightly, a frequency of about once a week, and often only under emotional stress (excitation) was obtained with treatment. A follow-up of cured cases showed that the cure was maintained. No complications or secondary reactions occurred apart from some development of the genitalia in boys who received large doses.

Theophylline in the Treatment of Asthma

THE use of theophylline in the treatment of 18 cases of asthma is recorded by A. Jacquelin, Turis, and M. Bourel (*Bulletin et Mémoires de la Société des Hôpitaux de Paris*, December 1946, 62, 587). The drug was given by oral, rectal, intramuscular and intravenous route, preference being given to rectal and intravenous administration. (Theophylline by mouth, in dose sufficient to act on the dyspnoea, i.e., 0.3 to 0.4 gm., is not well tolerated; gastric disturbances, nausea and vomiting, and vertigo occur, and the action is less constant than by other routes. Intramuscular injections are effective, but the drug acts more slowly and less surely than by intravenous route.) Suppositories containing 0.35 gm. theophylline were used, as the action on the asthmatic crises was marked: fifteen to twenty minutes after insertion signs of dyspnoea had disappeared, and the action lasted for two to four hours. Introduced at bedtime the suppositories prevented the nocturnal crises, and in the morning on waking they prevented the attack which frequently occurs when the patient jumps out of bed. According to the severity of the individual case, 1, 2 or 3 suppositories per twenty-four hours were prescribed. For intravenous injection ampoules of 0.25 gm. were employed. The injection must be given very slowly, and in five or six minutes the dyspnoea and cough disappear, the action lasting for four to six hours. In severe cases with persistent dyspnoea a suppository can be inserted four to five hours after the injection; control of such cases can be obtained by injection of 0.25 gm. morning and evening and a suppository of 0.35 gm. in the middle of the day. Of the 181 cases treated, success was obtained in 150.

A Complication of Aluminium Hydroxide Therapy

IN view of the extensive use of aluminium hydroxide in the treatment of peptic ulcer the following case, reported by G. P. Child et al

(*American Journal of Digestive Diseases*, February 1947, 14, 63) is of interest. Following a severe hæmorrhage, a thirty-six year old male, with a history of chronic duodenal ulcer, was treated with atropine and aluminium hydroxide. He continued with this treatment, and three months later there was a recurrence of acute pain and hæmorrhage. On examination the stools were found to contain small formed white masses, the passage of which persisted for five days and was accompanied by bouts of "constipation and diarrhœa, cramps and pain suggesting intestinal irritation". In all he passed about 40 small masses, varying from 5 to 25 mm. in length. Examination of these revealed that they consisted of aluminium salts of fatty acids together with a small amount of neutral fat.

The Sulphonamides in Rheumatoid and Infective Arthritis

In a review of the results obtained over a number of years in the treatment of cases of rheumatoid and infective arthritis, L. J. A. Parr and Eva A. Shipton (*Medical Journal of Australia*, March 15, 1947, 34, 323) record good results obtained with the sulphonamide drugs. The first drug to be employed was prontosil, trials with which had to be temporarily suspended owing to the development of a photosensitive rash; later it was found that when small doses were used (3 tablets per day; 1.5 gm.) the drug could be used with safety, and in acute cases with fever, doses up to 3 or 4 gm. daily. In view of its activity against *Streptococcus pyridans*, proseptasine was next employed in both acute and chronic cases with resultant alleviation in many instances. Sulphathiazole and sulphadiazine, which are active against *Staphylococcus aureus*, were then adopted and are now used by the authors when this organism is present in great numbers. In cases with septic foci, sulphaguanidine, in usual dosage of 2 gm. daily, proved of value. In view of these findings the procedure adopted by the authors is not to allow any focus of infection to be removed unless proseptasine or sulphadiazine is given both before and after removal, thus preventing exacerbation or extension of the disease, as frequently follows such surgical procedures. Gold therapy is used as an adjuvant to sulphonamide therapy, as it was frequently found that the exacerbations of arthritis following a common cold or extraction of teeth yielded readily to sulphadiazine. In a table giving the results obtained in 70 cases in which sulphonamides alone and in conjunction with gold were employed, cure was obtained in 22 cases with sulphonamides alone and in 5 with the combined therapy; improvement occurred in 17

with sulphonamides alone and in 10 with the sulphonamide-gold therapy; relapses occurred in 8 cases treated with sulphonamides alone, and there were no relapses with the combined therapy; 4 patients showed no improvement with sulphonamides and 3 failed to respond to combined treatment; there was one death among the patients treated with gold-sulphonamide therapy, and none in the sulphonamide group. Complications are discussed and measures for combating them, and also the necessity for supplementary treatment in the form of liver extract, yeast, calcium gluconate, iron, and blood transfusion. The importance of repeated blood counts is stressed, in view of the fact that to be successful, administration of sulphonamides must be prolonged—up to eighteen months.

The Dangers of Crossing the Legs

In reporting eight cases of unilateral peroneal palsy due to "the chronic habit of sitting with the legs crossed", S. H. Nagler and L. Ranzell (*Journal of the American Medical Association*, March 15, 1947, 133, 755) draw attention to the salient features of this condition. Because of its anatomic relationship the common peroneal nerve is exposed to injury as it bends round the neck of the fibula. Thus in such positions as crouching, squatting or kneeling it is exposed to both pressure and traction effects, and this may also occur when the individual sits with the legs crossed. This last factor is assumed to have been the cause of the palsy in the eight patients reported, all of whom were in the fighting forces; five of them were air crew technicians who had to work in cramped quarters of aeroplanes. The condition is more liable to occur in tall, long-legged persons than in short-legged individuals. The mechanism is stated to be compression of the nerve between the head and neck of the fibula of the uppermost leg on the one hand, and the patella and external condyle of the femur of the lowermost leg on the other. In the short-legged type of individual the distance between the neck of the fibula of the uppermost leg and the patella of the lower leg is as much as 6 inches (15.2 cm.), so that compression does not occur. As a rule peroneal palsy due to this cause does not result because there are preliminary paræsthesiæ which compel the victim to uncross the legs. It is recommended that in all cases of peroneal palsy of obscure origin this etiological factor should be considered. Treatment consists of instructing the patient not to cross the legs when sitting, whilst in more severe cases mechanical support of the foot, radiant heat, galvanism and large doses of thiamine chloride are recommended. The prognosis is good.

The therapy must be stopped immediately: on cessation of administration of vitamin D the symptoms rapidly disappear. Should the symptoms not disappear this may indicate the onset of meningitis; and particularly in infants who are being treated for a bacillary lesion the symptoms of vitamin D intoxication may mask an oncoming meningitis. Herein is a point of diagnostic significance. That the risk of vitamin D intoxication is not confined to children is shown by the report by P. Vallery-Radot, P. Milliez and A. Ryckewaert (*Bulletins et Mémoires de la Société Médicale des Hôpitaux de Paris*, December 1946, 62, 612) of three cases in adults of twenty-two, twenty-eight and forty-six years, taken from a number of cases of vitamin D intoxication observed during a period of some months. All three patients were receiving vitamin D₂ in high dosage for the treatment of tuberculous affections. The symptoms of intoxication included disturbance of water metabolism, renal insufficiency, digestive, nervous and cardiovascular disturbances, and anaemia. Although as a rule the symptoms of intoxication disappear with cessation of therapy, they may be serious or even fatal. These authors state that the toxic dose varies with the individual, but that oral administration is better tolerated than administration by intramuscular injection.

Chorionic Gonadotropin in the Treatment of Enuresis

A SERIES of 16 cases of enuresis in children of ages ranging from three to thirteen years in whom urinary findings were negative and to whom chorionic gonadotropin was administered is recorded by M. S. Cioffari and H. G. Clark (*Archives of Pediatrics*, February 1947, 64, 61). In practically all cases previous treatment had been undergone without success. Chorionic gonadotropin [antuitrin-S; (Parke, Davis & Co.,) 500 units per c.cm.] was given in initial dosage of 0.1 c.cm., twice weekly, the dose being increased according to tolerance to a maximum of 1 c.cm., twice weekly; 0.1 c.cm. to 0.2 c.cm. were given intradermally and the remainder subcutaneously. The usual limit was to six injections. No other medication and no orders were given. The method was adopted with the object of impressing on the mother, and still more on the subconscious mind of the child, that cure was going to be obtained, while at the same time the gonadotropin was developing the genito-urinary system. The treatment was continued until at least one week had passed without bed-wetting. Of the sixteen children treated 7 were cured, 8 improved, and in 1 case the treatment was unsuccessful. The cured cases

were mostly in the older age group: the classified as improved showed a definite betterment of the condition, i.e., whereas bed-wetting before treatment was three to five times weekly or even nightly, a frequency of about once weekly, and often only under emotional stress or emotion, was obtained with treatment. A follow-up of cured cases showed that the cure was maintained. No complications or secondary actions occurred apart from some development of the genitalia in boys who received large doses.

Theophylline in the Treatment of Asthma

THE use of theophylline in the treatment of cases of asthma is recorded by A. Jacquelin, Turiaf, and M. Bourel (*Bulletins et Mémoires de la Société des Hôpitaux de Paris*, December 1946, 62, 587). The drug was given by oral, rectal, intramuscular and intravenous route, preference being given to rectal and intravenous administration. (Theophylline by mouth, in doses sufficient to act on the dyspnoea, i.e., 0.3 to 0.4 gm., is not well tolerated: gastric disturbances, nausea and vomiting, and vertigo occur, and the action is less constant than by other routes. Intramuscular injections are effective, but the drug acts more slowly and less surely than by intravenous route.) Suppositories containing 0.35 gm. theophylline were used, and the action on the asthmatic crises was marked—fifteen to twenty minutes after insertion a sign of dyspnoea had disappeared, and the action lasted for two to four hours. Introduced at bedtime the suppositories prevented the nocturnal crises, and in the morning on waking they prevented the attack which frequently occurs when the patient jumps out of bed. According to the severity of the individual case 1, 2 or 3 suppositories per twenty-four hours were prescribed. For intravenous injection ampoules of 0.25 gm. were employed. The injection must be given very slowly, and in five or six minutes the dyspnoea and cough disappear, the action lasting for four to six hours. In severe cases with persistent dyspnoea a suppository can be inserted four to five hours after the injection control of such cases can be obtained by an injection of 0.25 gm. morning and evening and a suppository of 0.35 gm. in the middle of the day. Of the 181 cases treated, success was obtained in 150.

A Complication of Aluminium Hydroxide Therapy

IN view of the extensive use of aluminium hydroxide in the treatment of peptic ulcer the following case, reported by G. P. Child *et al.*

(*American Journal of Digestive Diseases*, February 1947, 14, 63) is of interest. Following a severe hæmorrhage, a thirty-six year old male, with a history of chronic duodenal ulcer, was treated with atropine and aluminium hydroxide. He continued with this treatment, and three months later there was a recurrence of acute pain and hæmorrhage. On examination the stools were found to contain small formed white masses, the passage of which persisted for five days and was accompanied by bouts of "constipation and diarrhœa, cramps and pain suggesting intestinal irritation". In all he passed about 40 small masses, varying from 5 to 25 mm. in length. Examination of these revealed that they consisted of aluminium salts of fatty acids together with a small amount of neutral fat.

The Sulphonamides in Rheumatoid and Infective Arthritis

IN a review of the results obtained over a number of years in the treatment of cases of rheumatoid and infective arthritis, L. J. A. Parr and Eva A. Shipton (*Medical Journal of Australia*, March 15, 1947, 34, 323) record good results obtained with the sulphonamide drugs. The first drug to be employed was prontosil, trials with which had to be temporarily suspended owing to the development of a photosensitive rash; later it was found that when small doses were used (3 tablets per day; 1.5 gm.) the drug could be used with safety, and in acute cases with fever, doses up to 3 or 4 gm. daily. In view of its activity against *Streptococcus pyridans*, prosectasine was next employed in both acute and chronic cases with resultant alleviation in many instances. Sulphathiazole and sulphadiazine, which are active against *Staphylococcus aureus*, were then adopted and are now used by the authors when this organism is present in great numbers. In cases with septic foci, sulphaguanidine, in usual dosage of 2 gm. daily, proved of value. In view of these findings the procedure adopted by the authors is not to allow any focus of infection to be removed unless prosectasine or sulphadiazine is given both before and after removal, thus preventing exacerbation or extension of the disease, as frequently follows such surgical procedures. Gold therapy is used as an adjuvant to sulphonamide therapy, as it was frequently found that the exacerbations of arthritis following a common cold or extraction of teeth yielded readily to sulphadiazine. In a table giving the results obtained in 70 cases in which sulphonamides alone and in conjunction with gold were employed, cure was obtained in 22 cases with sulphonamides alone and in 5 with the combined therapy; improvement occurred in 17

with sulphonamides alone and in 10 with the sulphonamide-gold therapy; relapses occurred in 8 cases treated with sulphonamides alone, and there were no relapses with the combined therapy; 4 patients showed no improvement with sulphonamides and 3 failed to respond to combined treatment; there was one death among the patients treated with gold-sulphonamide therapy, and none in the sulphonamide group. Complications are discussed and measures for combating them, and also the necessity for supplementary treatment in the form of liver extract, yeast, calcium gluconate, iron, and blood transfusion. The importance of repeated blood counts is stressed, in view of the fact that to be successful, administration of sulphonamides must be prolonged—up to eighteen months.

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A Synopsis of Orthopædic Surgery. I. A. DAVID LE VAY, M.S., F.R.C.S. London: H. K. Lewis & Co. Ltd., 1947. Pp. 15 and 242. Figures 55. Price 15s.

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DR. CHARLES BERG describes in this volume the psycho-analysis of a man well endowed physically and mentally who had failed to make a success of life. He had failed so far as business was concerned. He had failed so far as satisfactory relationships with men or with women

are concerned. Dr. Berg's approach is eudaimon. But this book is different from other psycho-analytical descriptions because it pre-emptes no technical acquaintance with the subject, and is a series of semi-verbatim accounts of the interviews which extended, it is presumed, over many months. It is not without technical terms, a useful glossary is appended, and the definitions are simple; indeed these, and the writing as a whole are remarkably clear. It makes the book easily readable. There is plenty at which the scoffers may scorn; the corrected may require further elucidation. But there is no article or book we know of which sets on record quite so clearly how psycho-analytic interviews are conducted, and although there may remain in doubt as to what the ultimate (or ? unconscious) purpose of this publication, it can be warmly commended as an attempt to record the method of what has been termed "character analysis".

Infectious Diseases: With a Chapter on Venereal Diseases. BY A. B. CHRISTIE, M.D., D.P.H. London: Faber and Faber Ltd., 1946. Pp. 324. Price 12s. 6d.

DESIGNED primarily for the instruction of novices of student nurses, this new book should also appeal to general and children's nurses and health visitors. The first part deals with the clinical details of the common fevers but also contains useful chapters on infective skin conditions, nursery infections (one of the best in the book), venereal diseases, and tuberculosis. The second part is devoted to the social and "applied" aspects of infections and includes such important topics as carriers, food-handlers, cross-infection and immunization. This is an up-to-date work, attractively arranged, adequately indexed and well produced, and should prove most useful to those for whom it is written.

Artificial Human Insemination: Report of a Conference held under the Auspices of the Public Morality Council. London: William Heinemann (Medical Books) Ltd., 1947. Pp. vii and 81. Price 3s. 6d.

THIS pamphlet gives the views of representatives of the Law, Psychology, Sociology, and the Roman, Anglican and Free Churches. Artificial insemination by the husband is not allowed by the Roman Catholic Church, whilst A.I.D. (when the donor is not the husband) is condemned by all churches. The legal view, which was put more fully by Mr. H. U. Willink, K.C., formerly Minister of Health, in *The Practitioner*, April, 1947, is that A.I.D. would constitute an

act of adultery and that the child would be illegitimate. Viscount Caldecote, although recognizing the high motives which had induced doctors to help sterile couples, feels that wider considerations would in time lead to the view that the practice was undesirable.

NEW EDITIONS

FROM among the many new sections that have been added to *Chemical Methods in Clinical Medicine*, by G. A. Harrison, M.D., B.Ch., M.R.C.S., F.R.I.C., in its third edition (J. & A. Churchill Ltd., 40s.) mention may be made of those dealing with the copper sulphate S.G. method for proteins, the analysis of post-mortem blood and cerebrospinal fluid, Barberio's test for seminal stains, and the congo red test for amyloid disease. These are but a few items chosen at random from a wealth of new material, and in view of the author's plan of adapting chemical methods to practical use in medicine, and the growing use of chemical analysis in the diagnosis and treatment of disease, practitioners will warmly welcome this new edition.

A Handbook of Midwifery, by Sir Comyns Berkeley, M.C., M.D., F.R.C.P., F.R.C.S., F.R.C.O.G., in its thirteenth edition (Cassell & Company Ltd., 12s. 6d.) has been brought up to date in accordance with advances since the appearance of the previous edition in 1943. The work is too well known to call for detailed criticism but the new edition will be found in every way to be up to the standard of its predecessors.

Gynecological and Obstetrical Pathology: with Clinical and Endocrine Relations, by Emil Novak, A.B., M.D., D.Sc., F.A.C.S., in its second edition (W. B. Saunders Company, 37s. 6d.) has been enriched by the addition of over 100 new illustrations, bringing the total up to 542. Students, clinicians, and pathologists in particular, will warmly welcome the author's foresight in thus providing elucidation of his text. The work has been submitted to revision and new material added in accordance with advances in knowledge in the past few years.

Blind Intubation and the Signs of Anaesthesia, by J. U. Human, M.R.C.S., L.R.C.P., L.D.S., D.A., in its third edition (H. K. Lewis & Co., Ltd., 10s.) has been enriched by the addition of a section devoted to "special cases" based on the author's finding of the need, when training anaesthetists, for clarification of the varying demands made upon the anaesthetist in connexion with some of the commoner surgical procedures. This little book fills a niche of its own in the vast subject of anaesthesia.

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NOTES AND PREPARATION

NEW APPARATUS

THE NEW MULTITONE M.T.3. HEARING AID is believed to be the smallest so far produced, measuring only $3\frac{1}{4}$ " in length with widest width of $1\frac{1}{8}$ ", and weighing only $2\frac{1}{2}$ oz. A new form of volume control has been used in its construction which automatically reduces the background noises as it is moved towards the minimum position by reducing the response of the instrument to higher frequencies. Supplied in an unbreakable plastic case with silver back and fittings, and reversible silver clips, the instrument can be operated with magnetic or crystal earpieces or with a bone conductor, and is provided with means for automatic connexion to the telesonic coil. A tiny silver knob at the top of the instrument actuates the drum-drive which switches the instrument on and off and varies the volume. The price is 25 guineas, without earpieces, and the manufacturers are the Multitone Electric Co. Ltd., 92 New Cavendish Street, London, W.1.

M.D., F.R.C.P., K.H.P., Director Army Medical Corps and President made an appeal to his comrades and to professional colleagues and members of other Services and public. There were many who were sick or wounded had passed through members of the Corps, who had opportunity to pay a practical and to the memory of those who had died of the Fund, of which I am Patron, and for which no money already been raised within the time to be devoted to the welfare of all ranks who fell in the war, and of all ranks who served in the families, who may be in need of or misfortune. Contributions to the Hon. Treasurer, R.A.M.C. Fund, c/o Glyn, Mills and Co. London, S.W.1.

THE NEW CARDIOPHONE is a three-stage stethoscope amplifier designed to provide discrimination between cardiac and respiratory sounds. It is entirely self-contained with integral batteries, finger controlled, small and light so that it can be carried in the lower waistcoat pocket, and can be fitted to the doctor's own stethoscope. The manufacturers are the N.E.P. (New Electronic Products) Laboratories Ltd., 261-3 Pentonville Road, London, N.W.1, from whom further particulars can be obtained.

"ALERT" CAR ALARM—This new burglary alarm, measuring $3" \times 2\frac{1}{4}"$, can be easily fitted in a cubby hole or other convenient part of the car. It is operated by a mercury switch enclosed in a vacuum tube, and movement of the car is enough to make contact which operates a circuit to a horn placed in a concealed place in the car. When the instrument is set a red indicating light shows, and a delayed action switch enables the alarm to be set and remain inoperative for half a minute so as to allow for movement of the car while doors are closed and locked. The Alert Alarm is manufactured by the Runbaken Electrical Products, Burton's Building, 71-73a Oxford Road, Manchester 1, from whom detailed particulars can be obtained.

THE ROYAL ARMY MEDICAL CORPS WAR MEMORIAL FUND

At a Press reception held at the R.A.M.C. Headquarters Mess, Millbank, on May 7, 1947, Lieut.-General Sir Alexander Hogg, G.C.B., M.C.,

THE REGISTER OF THERAPISTS

THE 1947 edition of the Register of Therapists has just been published. The Board of Registration of Medical and medical practitioners can obtain it of charge on application to the Board of Registration of Medical Practitioners, Tavistock House North, Tavistock Square, London, W.C.1.

THE CHARTERED SOCIETY OF PHYSIOTHERAPISTS

THIS is the title adopted by the Society previously known as the Chartered Society of Massage and Medical Gymnastics. The Society are known as Chartered Physiotherapists, or M.C.S.P. The President is Lord Horder, G.C.B. The address is Tavistock House North, Tavistock Square, London, W.C.1.

Quabaine Arnaud.—In the advertisement which appeared on page xxi of the *Journal of the Royal Society of Medicine*, of the tablets was given as 1/240 grain solution as 1/1,000. The correct strength is 1/24 grain and of the solution 1/100. The tablets are manufactured by the Laboratory Nanville Ltd., 74 Tottenham Court Road, London, N.1.

The contents for the July issue, which appeared on page lxxiv at the end of the advertisement.

Binding Cases for volume 158 (Jan.-June) with gilt lettering, are now ready for sale. The Practitioner, 5 Bentinck Street, London, W.1.

